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Division of Agriculture.

Annual Report for 1927.

Staff.

Mr. B. Bunting, Agriculturist, was in charge of the Division throughout the year.

Mr. E. A. Curtler, Assistant Agriculturist, returned from leave and resumed duty at the Experimental Plantation, Serdang on the 14th March.

Mr. H. Ritchings was appointed a Horticultural Assistant and reported for duty on the 2nd June.

Mr. F. S. Banfield was also appointed a Horticultural Assistant and reported for duty on the 27th June.

Mr. J. Lambourne, Assistant Agriculturist, proceeded on leave on the 16th July.

Expenditure and Revenue.

The total expenditure incurred on the Experimental Plantations during the year under review was $148,344 47, while the revenue from various sources was $16,314.82.

Experimental Plantation, Serdang.

Staff.—Mr. J. N. Milsum, Senior Assistant Agriculturist, and Mr. T. D. Marsh, Assistant Agriculturist (West Division), were stationed on the plantation throughout the year. Mr. J. Lambourne, Assistant Agriculturist, was in

charge of the East Division until the 28th February, when he was transferred to headquarters. Mr. E. A. Curtler, Assistant Agriculturist, returned from leave on the 14th March and assumed charge of the East Division.

Mr. F. S. Banfield, Horticultural Assistant, reported for special duty at Serdang on the 12th July and was stationed on the plantation during the remainder of the year.

Development.—Further progress was made in the development of this plantation and, during the period under review, an area of felled jungle on the East Division was burned off and clean cleared ready for planting.

In addition, an area of 21.95 acres of jungle on the same division was felled, burned and clean cleared with contract labour. This land has been provisionally reserved for the proposed Agricultural School at Serdang.

The area opened at the close of the year, including the reserve for the Agricultural School, was 771 acres, of which approximately 640 acres is planted with various crops. An area of about 755 acres, at present under secondary jungle, is being kept in reserve for future development.

Roads and Drains.—A new laterite road, about 21 chains long, was constructed at the northern end of the plantation, while a similar road, about 14 chains in length, was made at the southern end of the plantation, thus completing the circuit of roads. The total length of communication roads so far constructed on the plantation is approximately 6½ miles, which allows of easy approach to all the experimental plots.

Planting.—The following is a list of the principal crops planted during the year:—

Tapioca 8 acres, Sisal 7½ acres, Fruits (various) 5 acres, Tuba root (creeping and erect types) 4 acres, *Hydnocarpus anthelmintica* 2½ acres and Sugar Cane 2 acres.

Fruit Nursery.—The newly-opened fruit nursery was kept well stocked with seedlings of the various local fruits, some of which will be required for planting up the area at Serdang specially reserved for fruit cultivation and the remainder will be available for distribution.

Distribution of Planting Material.—As usual a large quantity of planting material was forwarded to headquarters throughout the year for distribution purposes. The material supplied included seeds and cuttings of the various economic plants under cultivation at Serdang, together with some of the more important fodder grasses and cover plants established on the plantation.

A fairly large amount of planting material of food crops, condiments and other minor economic plants was distributed free to school gardens in various parts of the Peninsula.

Although the majority of the planting material was distributed locally there was quite a considerable demand throughout the year from other tropical countries. In this connection it might be mentioned that two large orders for seeds of the oil palm (*Elaeis guineensis*) were received from both the Governments of the Gold Coast Colony and Sierra Leone with a view to establishing experimental oil palm plantations in those two countries.

Introduction of Planting Material.—The following is a list of the principal planting material which was introduced at Serdang during the year:—

Cinnamomum Camphora, seeds of three forms of camphor, one from a tree yielding solid camphor, one from a tree yielding light oil and the other from a tree yielding heavy oil, were received from the Royal Botanic Gardens, Kew. Further seeds of different varieties of oil palm were received during the year and included (a) four varieties (Edde, Sede, Kloude and Dechla) from the Department of Agriculture, Territory of Togo (b) five varieties (Abibe-Abepa, Abibe-Abetumtum, Adedam, Abetumtum, and Abefita) from the Department of Agriculture, Gold Coast Colony and (c) one thin-shelled variety through the Economic Botanist from Narborough Estate, Sungkai, Perak.

Tubers of several new sweet potato varieties were received from Java and a small collection of tubers of improved forms of the lesser yam (*Dioscorea esculenta*) from the Bureau of Agriculture, Philippine Islands.

Two different lots of pineapple suckers were received (a) the Ripley Queen variety from the Department of Agriculture, Fiji and (b) the Smooth Cayenne variety from the Department of Agriculture, Hawaii.

Seeds of *Taraktogenos Kurzii* were received from the Conservator of Forests, Rangoon and seeds of *Hydnocarpus anthelmintica* from the Siam Medicinal Oil Works, Bangkok, Siam.

Labour.—The supply of Tamil labour has shown considerable improvement and a further 170 coolies were recruited from India during the year. The number of Tamil labourers on the check-roll at the close of the year was 475 coolies. There is now an ample supply of labour on the plantation for all requirements, consequently recruiting was discontinued in December.

The school for the education of Tamil children resident on the plantation was continued and the average monthly attendance throughout the year was 25 pupils.

Health.—The health of the labour force was on the whole good. Altogether 153 admissions were made to hospital during the year. The Visiting Dresser from the Sungei Besi Dispensary attended the plantation weekly throughout the year, while the Second Medical Officer, Kuala Lumpur made regular fortnightly visits commencing from October.

The oiling of ravines and drains with a mixture of crude and solar oil was systematically carried out on the opened area.

Buildings.—All buildings on the plantation were maintained in thorough repair and wooden structures treated externally with wood preservative.

The following new buildings were erected during the year:—

1 Engine House.
2 sets of Cooly Lines (20 rooms each).
1 set of Kitchens (10 rooms).
1 Cattle Shed and Food Store.
1 Fruit Propagating Shed.
1 Fruit Packing Shed and Store.

Machinery.—A 30 H.P. Tangye Semi-Diesel Crude Oil Engine was transferred from Castleton Estate and installed in the new engine house during the early part of the year. This engine has since been used for driving the fibre decorti-

cating machinery and has proved more economical than the petrol engine formerly used for this purpose.

A double-disc power coffee pulper was obtained from Ceylon at the end of the year for dealing with the fruit from several small areas of coffee now coming into bearing.

Pests and Diseases.—As usual a certain amount of trouble was experienced with both pests and diseases, which is only to be expected with such a large range of crops under cultivation on the plantation.

An army caterpillar (*Amyna punctum*) made its annual appearance in the croton area and completely defoliated all the shrubs on a 10-acre block. A large Psychis (Bag-worm) attacked the leaves of *Aleurites montana* and the larvae were destroyed by hand-picking. A 5-year old oil palm was badly attacked by the Red-stripe weevil (*Rhynchophorus schach*), but examination showed that this was secondary to bud-rot. Caterpillars of the Coffee Clear-wing (*Cephonodes hylas*) made its appearance in the coffee area and might become a serious pest if not kept under proper control at the outset. The collection of bananas suffered somewhat severely from the attacks of the Banana Skipper (*Erionota thrax*).

Several cases of Foot-rot (Mal di Gomma) occurred in the lime area and resulted in a number of trees dying off. The disease was most noticeable amongst trees growing in pockets of comparatively poor soil, thus indicating that the affected trees had not sufficient nourishment to withstand the ill-effects of the disease.

Experimental Work.—An experiment was started in conjunction with the Agricultural Chemist with the object of ascertaining the optimum period between harvesting the leaves of sisal hemp. The plots are divided into 3 series, on one the leaves are harvested every 2 months, on another every 4 months and on another every 6 months. The yield of dry fibre is being taken from each cutting and laboratory tests as to the quality and tensile strength of the fibre under the different methods of treatment are also being carried out to ascertain whether there is any deterioration in the quality of the fibre obtained by cutting the leaves at different intervals of growth.

An experiment is also being carried out to test the comparative growth of sisal when plants are established from (a) bulbils and (b) suckers.

A block of Mauritius hemp was being harvested at the end of the year, when about 2½ tons of this fibre had been baled ready for shipment. It is hoped shortly to obtain a consignment of at least 5 tons of this fibre for making a trial shipment to London.

The cultivation of gambier as a catchcrop with oil palms has been continued and the yields of fresh leaf have been recorded. The area under cultivation has been divided into 3 different plots and the leaves from these are harvested at intervals of 3, 4 and 6 months respectively in order to test the effects of different intervals of growth on both the yield and tannin content of the leaves.

The experiments in the cultivation of tapioca were continued and a block of 10 acres reserved for this purpose was maintained under different forms of treatment throughout the period under review. The principal object of these experiments is to test the number of crops which can be taken off the land (a) without manuring, (b) with green manuring and (c) with artificial manuring. Representative samples of the root, stems and leaves are taken by the Agricultural Chemist at the time of harvesting the various plots in order to ascertain what constituents are removed by the crop under the different methods of treatment.

Investigations were undertaken during the year with two species of *Derris*, i.e. *D. elliptica* (tuba puteh) and *D. malaccensis* (tuba merah) which are commonly cultivated in Malaya for the purpose of export. Fresh material of these two species was periodically forwarded to the Agricultural Chemist for examination and material was prepared by him for insecticidal trials, which were carried out in the Entomological laboratory in collaboration with the Entomologist

A considerable amount of detailed experimental work was carried out on the plantation in connection with the cultivation of oil palms. The experiments, which have been continued from the previous year, include (a) records of growth, (b) effect of light, medium and heavy systems of pruning, (c) effects of artificial pollination, (d) records of individual yields and (e) the effect of intercrops, catchcrops, cover crops and green manures on the growth of the palms.

Experimental work was also carried out with various food crops, while a series of vegetable trials were undertaken with a view to collecting further data for the purpose of rewriting Bulletin No. 26, "Vegetable Culture in Malaya", now out of print.

A large number of investigations are in progress with other crops, the results of which are published periodically in the Malayan Agricultural Journal.

Stock Farm.—Considerable progress has been made in establishing a stock farm on the plantation with the object of carrying out preliminary experiments in the breeding of milch cattle. A herd of Montgomery cattle, consisting of one pure-bred bull, four cows, one two-year old heifer, one two-year old bull and one yearling bull comprise the stock introduced at the end of 1926. Three of the above cows calved during the current year producing three heifer calves. The herd was further augmented at the end of the year by the transfer of a yearling Montgomery bull and a pure-bred two-year old Jersey bull from Fraser's Hill.

The whole of the stock have thrived exceedingly well under the conditions obtaining at Serdang and up to the present time have been fed entirely on locally grown foodstuffs. Preliminary tests have already been made as to the suitability of various fodder grasses grown on the plantation with promising results.

A paddock of about 20 acres has been ploughed to eradicate lalang and when this work has been completed the area will be laid down with permanent pasture grasses for grazing purposes.

A substantial cattle shed and food store has been erected on the site specially reserved for the stock farm buildings.

A Poland-China boar was received from the Department of Agriculture, Manila at the close of the year and it is intended to use this in the near future for the improvement of local Chinese pigs.

Meteorological Observations.—Rain fell on 145 days during the year, giving a total rainfall of 97.47 inches, which is an increase of 10.44 inches on the previous year. The driest month during the year was July with a precipitation

of 1.11 inches and the wettest month was November with a precipitation of 16.09 inches.

The mean maximum temperature during the same period was 90.2°F (highest maximum 94°F) and the mean minimum 71.2°F (lowest minimum 69°F).

A sunshine recorder was installed on the plantation at the beginning of May and the total sunshine recorded during the last eight months of the year was 1,442.70 hours, which gives an average of 5.89 hours sunshine per diem.

A comparison of the rainfall records for the past six years, which are given below, may prove of interest:—

Year.	Number of days on which rain fell.	Rainfall in inches.
1922	199	87.86
1923	181	81.94
1924	241	92.37
1925	244	101.94
1926	181	87.03
1927	145	97.47

Visitors.—A large number of visitors were shown over the plantation during the year. The Chief Secretary to Government, the Hon'ble Mr. W. Peel, visited the plantation on the 11th January, accompanied by the Earl of Selbourne, K.G., G.C.M.G.

EXPERIMENTAL PLANTATION, CAMERON'S HIGHLANDS.

Staff.—Mr. J. P. K. Wilkins, Superintendent, remained in charge throughout the year.

Situation.—This experimental plantation is situated at Tanah Rata, which is approximately 4,800 feet above sea level, and the area allotted forms part of the south-eastern corner of the Highlands not far distant from the Robinson Falls.

Objects.—The principal object of this plantation is to carry out preliminary experimental work with such hill crops as tea, cinchona, cardamoms and mountain coffee, but attention is also being given to the cultivation of sub-tropical fruits, vegetables and ornamental plants.

Development.—Steady progress has been made in the opening up of this new plantation and at the end of the year an area of over 80 acres had been felled, burned and partially cleared of timber.

The work of stumping and clean clearing of timber has been carried out over a further area of about 10 acres in preparation for planting various seedlings now in the nurseries. The work included the snagging of the lower part of a stream which enters the Bertam River west of the nursery site.

Roads and Drains.—Attention was given to the construction of paths throughout the opened area and 26 chains of four-foot paths were constructed through the area reserved for planting cinchona and 33 chains of six-foot paths were made through the area reserved for tea cultivation.

Further, about 3,200 feet of silt pits, 2ft. x 2ft. x 20ft., were dug on the contour at 50 feet intervals throughout an area of 4 acres planted with tea.

Planting Operations.—The principal planting operations during the year were as follows:—

The transplanting of nearly 10,000 tea seedlings from nurseries to the field was undertaken during November/December. About 2 acres were planted at distances of 4 feet apart on the contour, while a further 2 acres have been planted on the square system at distances of 4 feet apart each way. The varieties so far planted are (a) Muttapong Manipuri, (b) Charali Manipuri, (c) Charali Assam, (d) Amulguri and (e) Dutea Assam.

The transplanting of cinchona plants from the nursery beds to their permanent quarters in the field was also carried out during November. Approximately 2,750 seedlings of *Cinchona Ledgeriana* and 1,700 seedlings of *C. succirubra* were planted at distances of 4 feet apart on terraces, the distance between the terraces varying from 6 to 7 feet. Unfortunately an unexpected spell of dry weather followed shortly after planting with the result that quite a number of the plants failed to become established. The resulting vacancies will be supplied as soon as the conditions for planting become more favourable.

A small plot, comprising about 200 plants, of Kent's Arabica coffee was planted out at a distance of 6 ft. x 6 ft. square during November.

Nurseries.—The nursery area has been extended and an area of about 1½ acres is now well stocked with seedlings of tea, cinchona, coffee and other crops with a view to planting up the opened area.

A number of ornamental plants are also being propagated in this area for future planting around building sites.

Introduction of Planting Material.—The principal planting material introduced during the year included the following:—

Seeds of five varieties of tea (Betjam, Dhonjan, Rajghur, Dangri and Charali) from Assam. Two lots of seeds of camphor (*Cinnamomum Camphora*), one supposed to yield solid camphor and the other yielding oil, were received from the Royal Botanic Gardens, Kew.

Seeds of two varieties of *Eucalyptus Naudiniana*, *E. globulus* and *E. citriodora* were received from England. Seed of the Cape Gooseberry (*Physalis peruviana*) was also received from Australia.

Other introductions consisted of seeds of fruits, vegetables, flowers and some less important economic and ornamental plants likely to thrive on the Highlands.

Labour.—The labour force at the end of the year consisted of 70 Tamil coolies, including men, women and children, which is ample for present requirements. All the labourers engaged during the year were free immigrants from India.

Health.—The general health of the labour force throughout the year was all that could be desired. An Assistant Surgeon was stationed at Tanah Rata from July onwards and his services were available for the treatment of coolies employed on the plantation when required.

Buildings.—The following buildings were erected on the plantation during the period under review:—

1 set of Cooly Lines (8 rooms)
1 Propagating Shed.

The other buildings on the plantation have been maintained in good order.

Pests and Diseases.—Insect pests were fairly numerous, but nothing of a serious nature so far appears to attack the more important crops namely, tea, cinchona and coffee. Considerable trouble has, however, been experienced with Cut-worms (*Rhvacia ypsilon*), which have caused serious damage to vegetable crops. The only satisfactory means of controlling this pest was systematic collection of the larvae.

Isolated cases of a fungoid disease made their appearance on the tea plots and affected specimens have been submitted to the Mycologist for examination.

Meteorological Observations.—Rain fell on 255 days during the year, giving a total rainfall of 127.26 inches as against 109.46 inches in 1926. The driest month during the year was May with a precipitation of 4.56 inches and the wettest month was September, with a precipitation of 19.98 inches.

The mean maximum temperature during the same period was 72.2°F (highest maximum 79°F) and the mean minimum 56.4°F (lowest minimum 47°F).

The total sunshine recorded was 1,461.10 hours for the year, which gives an average of 4.0 hours sunshine per diem. as against 4.25 hours during 1926.

General.—Mr. B. Bunting, Agriculturist, and Mr. J. N. Milsum, Senior Assistant Agriculturist, visited the Highlands during March in connection with the development of the plantation.

Mr. J. N. Milsum and Mr. F. S. Ward, Assistant Mycologist, also visited the plantation during September.

Experimental Plantation, Kuala Lumpur.

Staff.—Mr. A. L. Sinclair, Temporary Superintendent, Government Plantations, was in charge of this plantation until the 20th February, when he left the service.

Mr. H. Ritchings, Horticultural Assistant, assumed duty on the 2nd June and was in charge of the plantation during the remainder of the year.

Maintenance.—The plantation was maintained in good condition throughout the year, while considerable improvements were carried out in connection with the terracing and turfing of slopes and the enlargement of the existing nurseries.

Experimental Work.—A number of nursery beds was handed over to the Economic Botanist for carrying out selection work with a view to the improvement of such crops as soya bean, groundnuts, maize, cotton and padi.

A small area was also planted up with different varieties of bananas for the use of the Mycologist, who is undertaking special work in connection with the collection of types of bananas resistant to the Panama disease.

Buildings.—All existing buildings were maintained in good order. A new set of cooly lines (3 rooms) and kitchens were erected during the year.

Planting Material.—Considerable attention was given to the distribution of planting material and the requirements of no less than 556 applicants were satisfied during the period under review.

General Agriculture.

Numerous enquiries were received by the Division throughout the year regarding the cultivation of various subsidiary crops such as oil palm, pineapples, tapioca, coffee, tea, tuba root and sisal, thus clearly indicating that investors are on the look out for possible new forms of cultivation which may be profitably grown in this country. In this connection the oil palm has proved to be the most promising of such crops and, should present prices of oil palm products be maintained, there appears to be little doubt about the possible future development of this new industry in Malaya.

Coconuts.

The price of copra has shown a slight falling off compared with the previous year. Taking the Singapore quotations, the highest price for sun-dried copra was $12.00 per picul in October and November and the lowest $10.70 per picul in January and July, giving an average price of $11.18 per picul throughout the year, against $11.53 per picul in 1926. The export of copra from the Federated Malay States for 1927 was 57,536 tons valued at $10,142,826/- as against 65,829 tons valued at $12,851,770/- in 1926.

Oil Palms.

A greater interest is now being taken in the cultivation of this crop and it is estimated that the area planted with oil palms in British Malaya at the close of the year was approximately 18,300 acres. It is further estimated that about 2,550 acres of this area were in bearing at the end of the year.

The amount of reserve land held by oil palm estates at the end of 1927 is estimated at about 18,500 acres, to which must be added a further area of 8,000 acres alienated during 1927 for the cultivation of oil palms.

An area of about 125 acres at the Experimental Plantation, Serdang has now been planted up with oil palms for the purpose of carrying out experimental work on this particular crop. A further area has been reserved for conducting trials with different varieties of the oil palm and supplies of seed have recently been introduced from other countries with this object.

A special article entitled "The Oil Palm in Malaya" dealing entirely with the cultivation of the oil palm and the preparation of its products was published at the end of the year as a double number of the Malayan Agricultural Journal and also as Special Bulletin No. 39.

The export of oil palm products from the Federated Malay States during 1927 was 852 tons of palm oil valued at $269,966/- and 178 tons of palm kernels valued at $31,763/-. The corresponding exports during 1926 were 726 tons of palm oil valued at $254,165/- and 180 tons of palm kernels valued at $36,708/-.

Tapioca.

Numerous experiments in connection with the cultivation of tapioca are being carried out at Serdang, in collaboration with the Agricultural Chemist, and considerable data have already been collected regarding the investigations, which have as yet only reached the preliminary stage.

A preliminary report on (a) the different varieties of tapioca at present under cultivation at the Experimental Plantation, Serdang and (b) the effect of tapioca as a catch

crop with oil palms were published in the Malayan Agricultural Journal.

Pineapples.

The collection of pineapple varieties now established at Serdang was further augmented during the year by the introduction of suckers of new varieties from both Fiji and Hawaii. It will, however, take some considerable time before stocks of suckers will be available for purposes of distribution.

The export of canned pineapples from the Federated Malay States during the year was 3,968 tons valued at $822,719/- as against 3,940 tons valued $701,115/- in 1926.

Tuba Root.

The experiments being carried out at Serdang with different varieties of tuba (Derris) have been continued and sufficient material has now been obtained to plant up one-acre plots of two different varieties of *Derris elliptica* and two different varieties of *D. malaccensis*. The material harvested from these plots will eventually be used for carrying out further investigations on the relative toxicity of the four different forms.

Enquiries have recently been received from Home for tuba root, but supplies have not been forthcoming locally although as much as 25 cents per lb. f.o.r. Singapore or Penang have been offered for fine dry root.

The results of numerous examinations of tuba root produced at Serdang so far indicate that the very fine roots have the highest toxic content and also that the crop should be harvested within a period of 1½ to 2 years from planting, otherwise the root begins to lose its toxicity.

Coffee.

A number of enquires was received at the close of the year from proprietary planters regarding the cultivation of both the Liberian and Robusta varieties of coffee, thus indicating that attention is now being diverted to the planting of minor agricultural products.

The early maturing Robusta variety is to be recommended where it is intended to plant coffee as a catch crop, since the slow-growing Liberian variety is only suitable for planting as a sole crop.

As a rule there is a much better demand locally for the large-seeded Liberian type and it always commands a much higher price than Robusta on the local market.

Sisal.

Investigations being made at Serdang in connection with the cultivation of sisal have been continued, while several new experiments with this crop were started during the year.

An experiment was laid down to test the effect of unequal spacing of the plants between the different rows as opposed to the common square or rectangular system of planting. Under the former system two rows of plants are placed close together, say 3 or 4 feet apart, in a staggered position and between these and the next two rows is left a space of from 8 to 9 feet to allow of weeding and harvesting the leaves. Such an arrangement allows for double or treble the number of plants per acre which would be accommodated under the old system of planting, namely 8 ft. x 8ft. square or 680 plants per acre.

A shipment of 15 bales containing about 3 tons of sisal hemp produced at Serdang was made to London early in the year and realised £37-10-0 per ton. A report on the shipment in question revealed the fact that the fibre was well grown, measuring from 3 ft. to 4ft. in length, but the decortication, cleaning and general preparation was below the standard of East African No.1 Sisal. Considering that the decorticating plant at Serdang is only of sufficient capacity for carrying out experimental work, and therefore only capable of dealing with comparatively small quantities of fibre at a time, the report appears to be quite satisfactory.

Areca Nuts.

A considerable interest is being taken by the Asiatic population of Malaya in the cultivation of the areca or betel nut palm and a representative collection of the various local

types of nuts has been made by the Department and planted up at the Experimental Plantation, Serdang. The different types will be kept under observation with a view to the ultimate selection and cultivation of improved varieties.

The export of areca nuts from the Federated Malay States during the year was 1,356 tons valued at $219,110/-.

Chaulmoogra Oil.

It is interesting to record that the small experimental areas at Serdang planted up with *Hydnocarpus anthelmintica* and *H. Wightiana* both produced small quantities of seed during the period under review.

An article entitled "Hydnocarpus and Taraktogenos in the Federated Malay States," based on the experiments being conducted at Serdang, was published at the beginning of the year in the Kew Bulletin of Miscellaneous Information. This article was reprinted later in the Malayan Agricultural Journal, together with additional notes on the cultivation of *H. anthelmintica* in Siam.

Cover Crops.

As a result of further trials carried out with various cover crops at the Experimental Plantation, Serdang the following low-growing cover plants have been found the most suitable for cultivation on hilly or undulating ground for preventing soil erosion:—*Centrosema pubescens*, *Pueraria phaseoloides*, *Calopogonium mucunoides*, *Dolichos Hosei* and *Mikania scandens*.

Further experiments have shown that a combination of two or more cover plants gives much better results than planting a single cover plant and a combination of *Calopogonium mucunoides*, *Centrosema pubescens* and *Pueraria phaseoloides* has given most satisfactory results.

A paper entitled "Observations on the More Important Cover Plants in Malaya" was read by the Agriculturist at the Fourth Annual Conference of the Incorporated Society of Planters held in Penang on the 15th August. This paper was afterwards published in the September issue of "The Planter".

Publications.

The following articles were published by members of the Staff of the Agricultural Division during the year 1927:—

The Experimental Cultivation of Sweet Potatoes at the Government Experimental Plantation, Serdang. J. N. Milsum and E. A. Curtler, Malayan Agricultural Journal, Vol. XV, No. 1.

A Preliminary Report on Tapioca Varieties grown at the Government Experimental Plantation, Serdang. J. Lambourne, Malayan Agricultural Journal, Vol. XV, No. 2.

Hastening the Germination of Oil Palm Seeds. J. N. Milsum, Malayan Agricultural Journal, Vol. XV, No. 3.

A Preliminary Report on Tapioca as a Catchcrop with Oil Palms, J. Lambourne, Malayan Agricultural Journal, Vol. XV, No. 4.

Hydnocarpus and Taraktogenos in the Federated Malay States. B. Bunting and J. N. Milsum, Malayan Agricultural Journal, Vol. XV, No. 4.

Annual Report of Agriculturist. B. Bunting, Malayan Agricultural Journal, Vol. XV, No. 5.

Fodder and Grazing Grasses. J. N. Milsum, Circular No. 1/27.

The Oil Palm in Malaya. B. Bunting, B. J. Eaton and C. D. V. Georgi, Malayan Agricultural Journal, Vol. XV, Nos. 9 & 10. Also published as Special Bulletin No. 39.

General.

Numerous visits were made by the Staff of the Agricultural Division during the year to various estates throughout the country and advice was freely given on a variety of agricultural problems principally connected with the cultivation of crops.

B. Bunting,

Agriculturist, F.M.S. & S.S.

Division of Chemistry.

ANNUAL REPORT FOR 1927.

Introduction.—At the commencement of the year a rearrangement of staff was effected in order to facilitate work on soil problems. A Soil Division was created under the direction of the Plant Physiologist and Mr. Dennett and and two Malay Assistants were attached to the New Division. In other respects the staff of the Chemical Division remained the same as in the previous year.

The policy of the division has been to concentrate on investigations connected with the agricultural work in progress at the Government Experimental Plantation, Serdang and on the technical problems related to the production of copra and palm oil on local estates.

In the first half of the year it was necessary to complete some outstanding investigations on Hevea latex but with the publication of results in the Malayan Agricultural Journal for February and August this work was brought to a conclusion.

Coconuts.—In connection with the coconut industry it was considered that one of the most urgent needs was an enquiry concerning the reputed inferiority of Straits copra compared with that produced in Ceylon and Malabar. Climatic conditions are not wholly responsible and it is hoped that an improved reputation can eventually be made.

It has been suggested that the price of copra shall be determined by the oil content of the material offered for sale. This presents difficulties connected with the sampling and analysis of the copra and implies the establishment of criteria which would be fair to producer and crusher. With the object of exploring the possibilities a considerable number of analyses have been carried out on fresh and stored copra and local methods of preparation have been studied. The work is still incomplete but the results to date are promising.

In connection with the cultural side of the coconut industry a feature of the work of the Chemical Division has

been the examination of an extensive series of selected nuts for the Economic Botanist's selection experiments.

Oil Palm.—The development of the oil palm industry during the year has given rise to a number of problems concerning the efficient production of a high grade oil. The Chemical Division has been able to give help in improving the efficiency of the centrifugal expression process and has collected data relative to the local preparation of palm oil. The publication "The Oil palm in Malaya", Malayan Agricultural Journal Vol. XV, Nos. 9 & 10 embodies the results obtained.

The need for information concerning the consumption of soil constituents by the oil palm has led to the analysis of a series of samples of the leaves and male flowers collected from the palms growing in different areas. Further work on the nitrogen, potash and phosphate contents of the fruits and fruit stalks is being undertaken.

Experimental Plantation.—The investigations in progress at the Government Experimental Plantation Serdang have given rise to parallel chemical studies on the following crops:—Tapioca, tuba, sisal, gambier, kapok and a study has been made of the rotting of waste vegetable matter to prduce a satisfactory fertiliser.

The work on tapioca had for its object the determination of the optimum cultural conditions for the crop and the consumption of potash, phosphate, calcium and nitrogen under those conditions. The investigation has given rise to problems connected with the determination of phosphate by a colorimetric method and it has also been found desirable to investigate the efficiency of methods available for sampling a standing crop.

The results which will shortly be ready for publication in the Malayan Agricultural Journal appear to be an advance on those generally accepted and should prove of distinct value in other investigations on tapioca and similar root crops.

A study of the insecticidal value of different varieties of tuba has been commenced in collaboration with the Government Entomologist. The method established at Rothamstead of evaluating the dry root by its ethereal extract is being in-

vestigated with a view to determining how this is related to the toxicity of aqueous extracts of the fresh root.

A simple means has been found for separating the toxic bodies from aqueous extracts of the fresh root and it appears desirable to study the physical properties of these before deciding the insecticidal merits or demerits of any particular variety of tuba.

The investigations on sisal hemp and gambier have been concerned with the optimum periods at which the crops may be harvested. Series of samples taken from different experimental plots are being examined at regular intervals of harvesting and the analytical results reported to the Agriculturist. Continuous records now extend over a period of eighteen months.

Work on similar lines to the ADCO investigations in England has been carried out with promising results. A colorimetric process for the estimation of pentosans has been found satisfactory for following the course of the decomposition of vegetable waste. Small trials have demonstrated the possibilities of controlling the rotting of pineapple waste, sisal hemp waste or padi straw to produce innocuous products, similar in characteristics to soil humus, without the addition of a proprietary activator, such as ADCO.

Investigations for the Forest Department.—In addition to the work associated with purely agricultural problems the chemical division has been engaged on investigations more closely connected with the activities of the Forest Department. These relate to jelutong, terap bast, and mangrove bark.

With regard to jelutong a satisfactory method of coagulation by boiling has now been worked out and is being adopted by Chinese producers. Of the two kinds of deterioration common to native jelutong the development of blackening has been overcome and investigations are being continued to determine whether the resinification and granulation observed in some lots of jelutong is due to particular characteristics of the latex or is induced by contamination with metallic salts.

The terap bast work has now been completed and it has been shown that the fibre is not suitable as a substitute for jute in the manufacture of a coarse yarn. There remains the

possibility that it would form a useful raw material for paper if available in adequate quantities.

Work on mangrove bark embraces the collection of data showing the tannin content of different kinds of bark in different localities and has necessitated the investigation of methods for routine laboratory determinations of the extractable solids in the bark. The data will be published in collaboration with the Forest Economist.

Production of Alcohol.—Investigations connected with the production of alcohol have occupied an appreciable place in the research work of this division. In relation to the cultivation of nipah as a source of industrial alcohol a considerable amount of information is now available and comprehensive articles have been prepared for publication on tapping yields and problems connected with handling and treatment of the juice.

The production of alcohol from rice though not significant for the same reasons as those pertaining to the nipah palm industry must be regarded as very important, and it has been considered desirable to collect data on the efficiency of the local methods. The results so far obtained disclose a serious waste of rice and the intention is to investigate the possibility of introducing improvements practicable for the native distillers.

Miscellaneous.—An endeavour has been made during the year to limit the miscellaneous analyses as far as possible in order to confine attention to the investigations reported above. The number of miscellaneous samples reported on included 50 samples of copra, 47 samples of jelutong, 22 samples of water, 2 samples of acetic acid and 130 samples of rubber from the Wilkinson Process. The number of Patent Specifications examined was thirty.

A revised Schedule of Fees for Chemical Analyses was drawn up in collaboration with the Chief Chemist, Institute for Medical Research and the Government Analyst, S.S. This was published vide Gazette Notification No. 7103 of 23rd December, 1927.

The draft of a Fertilisers and Feeding Stuffs Enactment has been prepared for submission to Government.

The following articles have been published in the Malayan Agricultural Journal:—

1. "The Rubber Content of Ammoniated Latex"—R. O. Bishop, M.A.J. Vol. XV, No. 1.

2. "Studies on Hevea Latex"—R. O. Bishop, M.A.J. Vol. XV, No. 2.

3. "Jelutong"—B. J. Eaton, C. D. V. Georgi and Gunn Lay Teik, M.A.J. Vol. XV, No. 3.

4. "Kapok"—R. O. Bishop and Gunn Lay Teik, M.A.J. Vol. XV, No. 4.

5. "Studies on Hevea Latex"—R. O. Bishop, M.A.J. Vol. XV, No. 8.

6. "Variation in Plantation Rubber"—B. J. Eaton and R. O. Bishop, M.A.J. Vol. XV, No. 8.

7. "The Oil Palm in Malaya"—B. Bunting, B. J. Eaton and C. D. V. Georgi, M.A.J. Vol. XV, Nos. 9 & 10.

8. "Jelutong"—C. D. V. Georgi, M.A.J. Vol. XV, No. 11.

R. O. Bishop,

Ag. Agricultural Chemist, F.M.S. & S.S.

Division of Economics.

Annual Report for 1927.

Staff.—A Chinese Translator, kindly lent by the Secretary for Chinese Affairs, was attached to the Division from the beginning of February.

Major Crops.

Coconuts.—The market for copra, which closed at the end of 1926 at $10.10 per picul (133⅓ lbs.) rose in January to $11.10. The price during 1927 shewed no great variation until October when the price rose to $11.53 per picul, declining at the end of the year to $11.50 per picul. The average price throughout the year was $11.17 per picul, as compared with $11.80, $11.95, $12.12 in the respective years, 1926, 1925 and 1924.

The feature of the year however, has been the relatively small supplies coming forward. As is shewn in the table of production, the net export from Malaya in 1927 was 18% less than the preceding year while the export figures for the Federated Malay States shew a drop of 12% over 1926. It is considered probable that the drought in 1926 accounts for this falling off in yield; the consensus of opinion being that the yield of nuts is not noticeably short, but the content is thin. The detailed figures are given in Table 1.

Owing to the difficulty of finding large areas of suitable land it is unlikely that any great expansion of the copra industry in Malaya can be expected.

Twelve years ago the area under coconuts was stated to be 157,600 acres, while at the present time it is computed to be 163,400 acres. The difference of 6,000 acres cannot be accountable for the increase from 7,700 tons to 65,800 tons of copra exported. The explanation for this increase, even allowing that the early statistics of area may be less accurate than the present, is that the heavy period of planting must have been a few years prior to 1914, the effect of this period of planting being only now reflected on yield.

TABLE 1.

Export of Copra from Federated Malay States.

State.	Quantity in Tons.				Value in Dollars.			
	1924	1925	1926	1927	1924	1925	1926	1927
Perak -	38,545	40,007	44,542	39,499	6,914,055	7,830,274	8,905,033	6,862,402
Selangor -	12,900	15,426	16,963	14,120	2,427,188	2,909,119	3,212,553	2,615,641
Negri Sembilan -	1,179	2,236	3,417	3,302	203,930	463,494	575,451	562,528
Pahang -	560	313	907	615	95,839	57,412	158,733	102,255
Total F.M.S. -	53,184	57,982	65,829	57,536	9,641,012	11,260,299	12,851,770	10,142,826

The net export of Copra from British Malaya during the last three years was as follows:—

Net Export of Copra from British Malaya.

Year.	Quantity (tons)	Value Dollars.
1925	96,554	19,093,938
1926	104,653	21,852,330
1927	86,649	16,562,493

Rice.—Statistics of the rice production in Malaya are to be found in the report of the Economic Botanist.

The Economic Division addressed a memorandum to the Secretary for Agriculture on the general question of rice supplies of Malaya. It was pointed out that on account of growth of population and establishment of other industries, the population of many rice eating countries could no longer satisfy, from internal sources, their rice requirements. In consequence, each successive year witnessed stronger competition for the surplus rice of India, Siam and Cochin China. The Malay States were compelled to enter into competition for the purchase of supplies. The result of the growing competition is seen in the ever increasing price of rice, which is reflected in the general increased cost of living in this country. Proposals concerning the storage of rice or padi do not strike at the root of the trouble; storage would only be effective in insuring against temporary embarrassment of a food shortage caused by inability to import sufficient rice. The only solution to the problem, in so far as it affects Malaya, is by increased rice production within her territory. Suggestions are made towards the attainment of this object, which recent developments indicate may be followed.

Miscellaneous Crops.

After the three main crops of Rubber, Coconuts and Padi, there is a considerable drop in importance of the remaining crops grown in Malaya. Crops of secondary importance are Tapioca, Pineapples and Oil Palms; and lower in the scale Nipah, Areca Nuts, Coffee, Gambier, Bananas, Sago and Kapok. Any or all of these crops are suitable for cultivation on plantation conditions, and have possibilities of a market outside Malaya. The following figures of areas under miscellaneous crops have been compiled with the assistance of the Field Officers and this Department and the Land Offices. No returns were received from the States of Kelantan and Trengganu. See Table 2.

Oil Palms.—While no sensational development of this new industry was made during the year, the progress of planting and the general development of estates has proceeded unchecked.

TABLE 2.

Acreage of Miscellaneous Crops in Malaya.

State.	Secondary Crops.			Minor Crops.							
	Tapioca.	Pineapple.	Oil Palms.	Nipah.	Areca Nuts.	Coffee.	Gambier.	Banana.	Derris.	Sago.	Kapok
Selangor -	1,180	2,637	11,075	5,750	...	5,443	...	...	40	...	17
Perak -	179	377	1,516	4,285	241	249	...	...	378	106	73
Negri Sembilan -	293	149	600	413	...	281	294	2,055	269	...	...
Pahang -	300	3	...	...	...	689	1,770	...	57	...	257
Total F.M.S. -	1,952	3,166	13,191	10,448 *	241	6,662	2,064	2,055	744	106	347
Penang & Province Wellesley -	433	644	...	970	808	115	...	...	...	...	...
Malacca -	230	212	...	...	...	148	67	...	...	...	...
Singapore -	...	1,000	...	...	...	...	...	...	...	...	...
Total S.S. -	663	1,856	...	970	808	263	67	...	...	...	...
Johore -	14,000	25,000	5,130	...	8,000	...	3,000	...	1,400	700	...
Kedah -	7,638	544	...	...	...	587	...	1,960	3	...	27
Total U.M.S. -	21,638	25,544	5,130	...	8,000	587	3,000	1,960	1,403	700	27

* Including areas worked for "atap"

TABLE 3.

Annual Planting of Oil Palm in Malaya.—(Acres).

State.	Year.												Total.
	1913	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	
Selangor -	20	100	253	270	440	951	393	1,775	1,908	1,440	2,022	1,503	11,075
Perak -	...	...	...	...	...	...	...	...	220	...	478	1,818	2,516
Negri Sembilan -	...	...	...	...	...	...	...	...	...	...	100	500	600
Johore -	...	...	...	...	...	...	...	...	10	962	1,289	2,869	5,130
Total Planted Annually -	20	100	253	270	440	951	393	1,775	2,138	2,402	3,889	6,690	19,321
Total Planted to date -	20	120	373	643	1,083	2,034	2,427	4,202	6,340	8,742	12,631	19,321	

There are now twenty-five oil palm estates, an increase of six over the previous year. Of these, three estates have over 2,000 acres planted, four estates have between 1,000—2,000 acres planted, and ten estates have between 400—800 acres planted. The amount of reserve land held by oil palm estates is 18,500 acres. In addition, during 1927, over 8,000 acres of land was alienated for oil palm cultivation.

Table 3 shews the progress of planting to date. Small experimental areas are not included.

The area of land ear marked by Government for alienation for this form of cultivation, but not yet alienated stands at about 118,000 acres. It must be remembered however, that it is not yet known whether these areas are all suitable for oil palm cultivation.

There are now four up-to-date oil extraction plants erected on Malayan oil palm estates, being an increase of two during the year under review. The total crop harvested since the commencement of the industry is as stated in the table below.

TABLE 4.

Yield in Tons of Palm Oil and Kernel in Malaya.

Description of Product.	YEAR.				
	1923	1924	1925	1926	1927
Palm Oil -	195	286	536	751	915
Kernels -	50	81	110	168	185

At the suggestion of this Division, imports and exports of palm oil and kernel are now included in the official monthly returns published by the Registrar of Imports and Exports. The figures for 1927 places the net export value of oil palm products at $274,061.

A considerable increase in total crop is anticipated in 1928, as new areas will come into bearing, and machinery on two estates will for the first time have worked throughout the year.

The price of the African products at the beginning of the year stood at about £39 per ton for palm oil and £20

per ton for kernel. A drop of about £6 per ton was experienced about the middle of the year, due to the report of expected large increased supplies of cotton seed oil. The price recovered to about £38 per ton by December. The Malayan palm oil realised prices in advance of those quoted for the supplies from Africa. Palm kernels have been steady throughout the year, closing at slightly higher prices.

Coffee.—There has been a noticeable increase in the planting of coffee during the year. In view of the very large imports of coffee for consumption in Malaya, this increase is most encouraging. The position has not changed materially since the last report of this Division was written, when it was pointed out that some 25,000 acres more of coffee were required to render the country self-supporting in this respect. In addition to the local market, there would appear to be excellent prospects of business with other countries. It has been pointed out that the duty of £28 (Sterling) per ton levied on all coffee imported into Australia has now been amended to allow of all coffee grown in British territories admittance duty free. This gives a preferential treatment over foreign competitors which should attract renewed interest to this form of cultivation in Malaya.

The majority of the Malayan coffee is of the Liberian type, grown from seed of more or less obscure origin, and is mostly situated in the Kuala Langat and Klang Districts of Selangor. Most of this coffee is grown by Malays and Chinese, who sell the ripe berries to local traders who dry and prepare the coffee for sale.

The following import and export figures of the coffee trade of Malaya may help to emphasise the potential value of this crop.

TABLE 5.

Malayan Imports and Exports of Raw Coffee.

	Imports.		Exports.	
Year.	lbs.	Value. $	lbs.	Value. $
1925	18,878,848	6,469,775	11,788,036	4,113,318
1926	18,515,244	6,084,110	9,931,876	3,319,597
1927	18,612,643	5,144,631	10,074,931	2,771,496

Pineapples.—Reference to the table of areas of miscellaneous crop shews that the area under pineapple cultivation is well maintained, and there is no reason to anticipate a falling off of supplies in the near future provided the demand remains reasonably steady. The following figures of exports of canned pineapples during the past nine years is compiled from official returns:—

TABLE 6.

Export of Canned Pineapples from British Malaya.

Year.	Quantity.	Value (dollars).
1919	255,973 cases	3,286,001
1920	446,893 ,,	7,178,016
1921	662,630 ,,	6,210,383
1922	710,671 ,,	6,694,098
1923	889,941 ,,	5,874,858
1924	39,204 tons	8,873,977
1925	43,207 ,,	8,236,824
1926	40,634 ,,	7,669,784
1927	40,134 ,,	8,296,656

The market experienced many vicissitudes during the year. Producers held out for higher prices, which Overseas Markets would not meet, thereby causing the accumulation of abnormal stocks. The position was aggrevated by a smaller demand from the United Kingdom, due to bad weather and competition. Local financial adjustments were finally effected which eased the situation, the produce coming on the market at London ruling prices.

Recent advice is that the prospects have improved, although supplies are plentiful.

Consideration has been given to the possibility of improving the export trade in this commodity, but the present is thought to be inopportune for a pronouncement on the subject.

Tapioca.—Tapioca cultivation is now of little importance in the Federated Malay States, although in the Unfederated Malay States, particularly Johore and Kedah, where new areas of virgin land are being brought into cultivation, tapioca is still a well-favoured crop.

Prices throughout the year have shewed a strong upward tendency. In January "flake" was quoted locally at $5.20 and "pearl" at $8.30 per picul. The rise in price has been uninterrupted to December when the last quotations were $9 3/8 for "flake" and $9.50 for "pearl".

In consequence of an enquiry from England, consideration was given to the possibility of importing standardized machinery for the manufacture of tapioca. It was eventually advised that the machinery necessary was not in such demand as to warrant importation as indicated, and was so simple of construction that it could be made locally without great engineering skill.

TABLE 7.

The Tapioca *Trade of Malaya.

Year.	Imports.		Exports.	
	Tons.	Value $	Tons.	Value $
1925	6,010	762,582	37,000	4,818,528
1926	7,445	871,884	36,706	4,375,743
1927	8,085	905,672	35,139	4,243,992

Areca Nuts.—The production of areca nuts forms an important industry in Johore, and to lesser extent, in certain other parts of the country, generally near the sea. The Economic Division has pointed out that the present areas could be made to produce larger crops of better quality which would make the cultivation of areca nuts a more favourable industry.

There was some decline in production, as shewn in the table below, due very largely to the abnormal rains at the

* Excluding the trade in Refuse and Root.

end of 1926, and beginning of 1927. The imports from Java were below average, indicating abnormal conditions in that country. Quality as well as quantity was affected by the rains, and as India obtained normal quality, the price of the local produce suffered. The average Singapore prices of the various grades of areca nuts was as follows:—

Palembang whole $7.15; whole $6.04; Split $11 20; Red whole $15.23; Sliced $24.08; Kelantan $8.84.

The average price of imports for the year was $183 per ton, and for export $206 per ton.

TABLE 8.

Malayan Imports and Exports of Areca nuts.

Year.	Import.		Export.	
	Quantity (tons).	Value $	Quantity (tons).	Value $
1925	39,952	10,007,864	58,902	18,293,061
1926	40,497	9,396,674	63,012	17,286,800
1927	32,110	5,876,087	49,873	10,298,771

Gambier.—The gambier market has proved featureless, and some cultivators have found it unprofitable to harvest their crops. The price for block gambier opened at 8\frac{3}{4}$ per picul, and with small fluctuations closed the year at about $7.50 per picul. Cube gambier likewise has continued to decline from $17/- per picul to. $15.50—$14/-. With adequate supplies coming forward from the Dutch Colonies, these appears little prospect of an early rise in price.

Derris.—This comparatively little known insecticide is engaging the attention of investigators in various countries. Samples and trial shipments have been sent which it is hoped will eventually lead to established markets in various parts of the world. The Inspector of Agriculture Johore advises that there is increased activity in the cultivation of this crop in Johore for export to Japan. American enquiry has been met with full information, which it is hoped may lead to business with that country.

Kapok.—No advance has been made in the cultivation of this crop in Malaya. The utilization of the seed, which the

Economic Division advocated some time ago, is again engaging attention, and it is anticipated that connections for a market will shortly be established.

Sireh.—An investigation was carried out of the Sireh industry in Selangor. No estimate of area is possible, as the vines are planted in small plots scattered throughout the State. Three varieties are recognised by the natives, all of which are grown locally. The retail prices vary according to variety and district, between 15 and 20 cents per 100 leaves, which allows for a very satisfactory profit for the cultivator and dealer. It is understood that there is a surplus of stock available in Kedah, but it is extremely doubtful whether its transport to Kuala Lumpur would be remunerative. As matters stand, each State—with the possible exception of places such as Singapore and Penang—are able to grow their supplies, and any increase in the area under cultivation would ruin the market.

Ginger.—The possibilities of producing ginger on a commercial scale is being investigated. The present important producing countries are Jamaica, India, Sierra Leone, Japan and China. In the aggregate, these countries export about 12,000 tons of which half is produced in Japan and China. Through the good offices of a firm in China, and of the Hong Kong General Chamber of Commerce, detailed information of the China trade in ginger has been obtained. These facts will be studied in relation to the possibilities of production in this country.

Tea.—The possibilities of the profitable production of tea is of importance when it is realised that the local consumption in 1927 amounted to nearly ten million pounds in weight, valued at over four million dollars. Samples of the grades of tea consumed in Malaya, together with prices, were submitted to a planter with practical experience of tea cultivation. Provided that tea of the grades desired can be produced locally, a considerable local market awaits the development of the industry.

The world demand for high quality tea is increasing, and there appears to be no reason why Malaya should not take a share of production.

Reports, which the writer has seen, indicate that in respect of quality, Malaya should be able to satisfy the demands of the market.

Papain.—Enquiries are occasionally received regarding the production of papain from the papaya fruit. This product has been produced experimentally in Malaya, while in Ceylon, the industry has been established for some years. In reply to a request, the Director of Agriculture Ceylon states that the market has fallen owing to over supply, while the largest producers have fixed contracts with purchasing firms in the United States.

Patchouli Oil.—Owing to higher prices, there has been a revival of this minor industry. Improvement of price almost invariably brings new distillers into the market, and not infrequently lowers the quality of the product. In consequence, the market is swamped in a short time, by shipments on consignment. Distillers are urged that their best opportunity is to maintain quality and ship on orders only.

Live Stock.

Statistics of live stock are exceedingly difficult to collect owing to the fact that the stock are generally scattered throughout the country. The following table is compiled from returns submitted by District Officers. No returns are available for the Straits Settlements and the Unfederated Malay States.

Very serious loss of buffaloes in Pahang was experienced early in 1927 by reason of floods, there being 16,000 buffaloes less in the State compared with the previous year. Such a loss is not only the occasion of hardship to the owners—Malays in most cases whose form of saving is frequently by increase of their herd—but is likely to be reflected on the production of rice within the State. In many districts, buffaloes are used for the cultivation of the swamp for padi, and cultivation by other methods is often most difficult owing to the depth of the mud.

In most other districts throughout the country a decrease in the number of the stock is to be recorded. Hardship caused by the floods and disease are mainly responsible for this result, and it is to be feared that no advance may be expected until research has solved the problem of disease and its control, and the regulation of breeding.

TABLE 9.

Live Stock in Federated Malay States 1927.

	Bullocks.			Buffaloes.			Goats.		
	Male.	Female.	Total.	Male.	Female.	Total.	Male.	Female.	Total.
Perak ...	10,048	7,537	17,585	6,436	8,806	15,242	11,347	25,002	36,349
Selangor ...	--	—	6,805	—	—	2,122	—	—	—
Negri Sembilan ...	3,715	4,218	7,933	3,585	5,881	9,466	7,162	12,048	19,210
Pahang ...	—	—	3,958	—	—	13,060	—	—	—
		Total ...	36,281		Total ...	39,890			

Shell Charcoal.

As a result of an opinion expressed at the International Rubber Exhibition 1927, that a market awaited steady supplies of shell charcoal—employed for the purification of liquids etc.—investigation was made as to possible supplies of such charcoal from oil palm and coconut shells. It was decided that the employment of oil palm shell effected such considerable saving in fuel in the factory that its export as charcoal could not be considered. In the coconut industry, about 70% of the shell is used for drying the copra, so that in the aggregate, the coconut industry of Malaya might be able to supply a considerable quantity of such charcoal if the market is as firm as was at first reported.

Figures have been collected of the actual cost of production and marketing, and the result of further enquiry in Europe by the Malay States Information Agency is awaited.

Vernacular Publications.

(a) *Warta Perusaha-an Tanah*, the agricutural journal in the Malay language. Volume V of this journal was published in four numbers. The principle articles were:—Orchard Economy; Disease of Fruit Trees; Varieties, Cultivation and Marketing of Areca Nuts; A Disease of Poultry; The Red Stripe Weavil; Processes Employed in Making Dyes; Rubber Cultivation on Lalang Land; Wet Rot (Poria) of Rubber; Misletoes attacking Cultivated Trees; Cover Crops; Careers open to Malays in the Agricultural Department; and Ikan Sepat, a fish suitable for Rearing in Padi Areas.

The Volume contains 19 illustrations—one being in colour.

The circulation of the Malay journal has shown an increase of 500 copies per issue so that the circulation at the end of the year stood at 3,500 copies per issue.

The following special leaflets were published. These were used in connection with the distribution by the Department of planting material in areas which suffered severely from floods in January.

No. 3. "Cultivation and Cooking of Maize and preparation of "Gaplek' from Tapioca." (15,000 copies in Malay and 2,000 copies in English).

No. 4. "Advice to Malays in Pahang" (2,000 copies in Malay).

No. 5. "Cultivation of Hill Padi" (2,000 copies in Malay and 2,000 copies in English).

(b) *The Chinese Agricultural Journal*—a Chinese agricultural journal of the Department commenced in June, and the first volume, consisting of three parts, was completed. The principle articles were:—Soil Cultivation and Conservation; Cover Crops; Diseases of Fruit Trees; Tapping Factors which influence yield of Rubber; Wet Root Rot (Poria) of Rubber; A Disease of Poultry; A Disease of Pigs; The Giant Snail; The Preparation of Agricultural Products for Sale; The Water Hyacinth; Coffee; The Avocado Pear; and Kapok. The volume contains seven full page illustrations, one being in colour. Five thousand copies of each issue were printed, and the growing demand for copies, as the journal becomes more widely known, will probably justify an increase in the near future.

Excluding Special Leaflets, 27,000 copies of vernacular publications have been printed and distributed, at a cost (excluding salaries) of $5,743, while sales and advertisements have produced a revenue of $1,568.

The following table shews the proportionate distribution of the above two quarterly journals to various parts of the Malay Peninsula.

TABLE 10.

Distribution of Vernacular Journals.

	Malay Journal.	Chinese Journal.
F.M.S.	54%	38%
S.S.	22%	23%
U.M.S.	22%	14%
Outside	2%	25%

The Malay Journal is now firmly established and widely read in Villages and Schools. Proposals were made to widen the scope of this publication, but were not approved by Government.

The reception given to the new Chinese Journal has been most encouraging. Letters of enquiry on various agricultural subjects have been received from places as far apart as Brunei and Siam.

The present opportunity is taken of acknowledging the free use which has been made of the publications of scientists in and out of the Department of Agriculture and of altering and adapting various articles for the purposes of these publications.

Agricultural Shows.

The following Agricultural Shows were held during the year:—

Balik Pulau, April 16, 17, 18.

Perlis, May 14, 15.

Malacca, July 16, 17.

Banting, July 16.

Rembau, May 28.

Kuala Pilah, June 18.

Taiping, August 27, 28.

Seremban, September 17.

The Fifth Malayan Exhibition was held at Kuala Lumpur, July 29th to August 1st inclusive.

With the exception of Perlis, all the above events were held under the auspices of the Malayan Agri-Horticultural Association, of which the writer is Joint Hon. Organising Secretary. The writer officiated as a judge at four of these District Shows.

The Association commenced a quarterly publication during the year to which the Agricultural Economist submitted articles. This publication has assisted in drawing together the Agricultural interests of the members. The interest aroused by all of the above shows continues to stimulate the native to consider quality more than he has done hitherto, and has also proved an incentive to the importation of improved stock, especially of poultry. The Association's successful endeavours to create a market for the arts and crafts of the villages is considered to be a valuable asset in connection with the contentment and well being of the native cultivator.

Miscellaneous.—The Agricultural Economist acted as Assistant to the Secretary for Agriculture in addition to the duties of his substantive appointment. He also served on the Advisory Committee of the School of Agriculture, Malaya; and as Secretary of the Agricultural Advisory Committee.

The portion of the "Handbook of British Malaya" dealing with Agriculture was rewritten and forwarded for publication.

The writer read a paper on "School Gardening" at the Second Conference of Malayan Teachers, at Ipoh on August 10th.

D. H. Grist,

Agricultural Economist, F.M.S. & S.S.

Division of Economic Botany.

ANNUAL REPORT FOR 1927.

STAFF.

Mr. R. B. Jagoe Agricultural Field Officer, Selangor, was transferred from the Field Division to this Division as an Assistant Economic Botanist as from October 18th, but did not take up his new duties during the period as he could not be released from his field duties until the close of the year.

Inche Mohamed Noor was in charge of Titi Serong Padi Experiment Station, assisted by Che Abdul Rauf and Che Abdul Rahman did splendid work as Field Assistant for coconuts.

Inche Puteh bin Tamby Kechil. Junior Agricultural Assistant was appointed to the Division as from April 8th and proved himself a useful officer.

PADI.

Except in Kedah, Penang, Province Wellesley and Malacca, padi crops were bad on account of the flood in the latter stages of growth of the padi and very adverse weather during harvest. Much grain, after it was cut, was lost owing to continual showery weather which caused germination of the padi and rendered it useless for milling. Rats too were exceptionally destructive to the crops everywhere as a consequence of the floods. In Krian alone over 200,000 rats were killed during the harvest and Krian was no worse than many other districts. In Pahang, Lower Perak and Kelantan the crops suffered most severely, the entire crop in some padi areas being wiped out. In Krian the crop only amounted to 9,493.654 gantangs of padi or approximately only 68% of the average of the past fifteen years.

Pure-line selection work was maintained at Titi Serong along the lines already laid down though 1927 figures cannot be considered of value in computing results owing to extensive flood damage. Further evidence of the wide distribution

of padi seed was gained by visiting several padi areas during and after harvest and by examining exhibits at various agricultural shows, when it was observed that Krian selected seed took numerous prizes.

Even in Kelantan, where 2 gantangs of seed of each of two strains were introduced by private enterprise in 1922-23, it was found that both strains were popular amongst cultivators, though the strains were somewhat mixed. A large consignment of selected seed was sent to Kelantan for trial in the present season. Over 95,000 gantangs of seed padi were distributed during the year, mostly to Pahang and parts of Perak where crops had been destroyed by the floods.

Padi manurial experiments at Kuala Kangsar were a failure because the area was totally submerged for some days and all the planted padi was washed away.

Fair results were obtained at Malacca and in Province Wellesley but no definite conclusions can yet be formed. The present crop started well in most areas but an unusual drought in October—November caused a serious set back in growth and gave rise to the incidence of pests, particularly rats and an insect styled "Sogata pallescens." The occurrence of satisfactory rains in December, however has given the crop a noticeable stimulus so that at the end of the year, the general crop appears to be about up to average. The usual padi statistics are shown in tabular form.

Coconuts.

For the seventh year in succession monthly records of individual yields of 530 palms were taken and these have provided instructive information concerning the variation in yield of individual palms in commercial plantations. It is shown (a) that over a period of seven years the coefficient of variability of an average population is as much as 37% of the mean production, (b) the variation in crop producing ability varies from 72% to 137% of the mean in an average population (c) that 19% of the palms on an average plantation are not profitable (d) that 13% of the palms produce 22% of the crop and (e) that poor yielders remain poor yielders. In view of these results the desirability of selecting seednuts from known high producing palms cannot be too strongly emphasised.

At the Coconut Selection Station, Klang, the planting of the 50 acre block with selected types was completed and arrangements made to secure an additional area of about 16 or 17 acres for an extension of planting.

The palms continue to make satisfactory progress.

A comprehensive series of manurial experiments are being made at the station as well as experiments in methods of cultivation and the use of cover and catch crops.

The manurial experiments are being duplicated on a ten acre block on Carey Island by courtesy of the management.

Arecanuts.

Twenty types of arecanuts have been planted in border rows at the coconut experiment station at Klang and all the young palms are showing excellent growth.

Maize.

Breeding experiments were continued with 27 selected types, inbred for five generations. From these, selections have recently been planted for hybridization purposes with a view to obtaining sound commercial types for testing on a field scale.

Soya Bean.

Selection experiments with this crop continue and promise interesting and useful results. Thirty-one isolated types were grown in Kuala Lumpur for the fifth generation and strains of No. 4, a locally collected variety, and of No. 3 a variety originally obtained from Siam show much promise.

Cotton.

Fifteen types of cotton, (including Sea Island, Egyptian and upland types) selections resulting from six season's work were planted and harvested during the year and gave quite good crops of seed cotton, pests scarcely being noticeable. The lints of these cottons were critically examined and it is interesting to note that they have maintained their quality over 6 seasons under local conditions. Selections were made for future plantings.

Oil Palms.

A preliminary survey of the various types of oil palm growing at Serdang Experimental Plantation is in progress

and indicates a fair degree of variation in this crop so that selection with this crop along scientific lines promises to be profitable.

Ground Nuts.

Selection experiments have been continued with this crop and 14 selections are still under trial, considerable variation being apparent.

Botanical.

The collection of economic plants was maintained and supplemented during the year. Numerous plants were identified for various officers of the Department.

Publications.

(a) Annual Report of the Economic Botanist, M.A.J. Vol. XV. No. 5 May 1927, by H. W. Jack.

(b) Abnormalities in the Coconut Palm, M.A.J. Vol. XV. No. 8 August 1927, by W. N. Sands.

(c) Variation in Coconuts, M.A.J. Vol. XV. No. 11 November 1927, H. W. Jack & W. N. Sands.

(d) Improvement of rice crops—Warta Perusahan Tanah, by H. W. Jack.

H. W. Jack,

Economic Botanist, F.M.S. & S.S.

Summary of Padi Returns—British Malaya.

Season 1926—1927.

State.	WET		DRY	
	Acreage	Yield	Acreage	Yield
	Federated Malay States.			
Perak ...	88,839	12,431,297	3,081	281,653
Selangor ...	17,311	3,754,300	3,175	415,108
Negri Sembilan ...	30,759	3,098,126	10	800
Pahang ...	21,953	2,141,942	1,325	40,819
Total, F.M.S. ...	158,862	21,425,665	7,591	738,380
Krian ...	54,362	9,493,654		
	Straits Settlements.			
Singapore ...	—	—	—	—
Penang ...	5,060	2,129,250	—	—
Malacca ...	25,409	8,303,706	—	—
Province Wellesley	39,050	8,600,000	—	—
Dindings* ...	400	40,000	330	33,000
Total S.S. ...	69,919	19,072,956	330	33,000
	Unfederated Malay States.			
Johore ...	3,756	167,840	1,395	172,991
Kedah ...	164,817	54,409,206	6,940	1,864,807
Perlis ...	36,432	8,916,600	45	13,440
Kelantan ...	116,887	13,030,000	57,050	5,721,000
Trengganu ...	8,000	1,000,000	4,000	400,000
Total U.M.S. ...	329,892	77,523,646	69,430	8,172,238
Total F.M.S. ...	158,862	21,425,665	7,591	738,380
Total S.S. ...	69,919	19,072,956	330	33,000
Total U.M.S. ...	329,892	77,523,646	69,430	8,172,238
Malaya	558,673	118,022,267	77,351	8,943,618

* Returns not available so that figures for previous year are given.

Division of Entomology.

Annual Report for 1927.

1. *Staff.*

The two vacant posts of Assistant Entomologist were not filled.

Mr. Cedric Dover was transferred from the F.M.S. Museums on a temporary basis on June 1st, 1927. I wish to place on record my appreciation of this officer's assistance.

2. *Publications.*

The following papers have been published:—

"Three New Aleyrodids on Coconuts in Malaya", M.A.J., XV, No. 1.

"Annual Report of the Government Entomologist for 1926", M.A.J., XV, No. 5.

"*Orgyia turbata* Butler, A possible pest of Rubber", M.A.J., XV, No. 7.

"Tortoise Beetle, *Aspidomorpha miliaris* Fabr.", M.A.J., XV, No. 7.

"The Copra bug, *Necrobia rufipes* de Geer.", M.A.J., XV, No. 7.

"The Oil Palm in Malaya (Insect Pests)", M.A.J., XV, Nos. 9-10.

"Notes on Miscellaneous Insects of 1926", M.A.J., XV, No. 11.

A paper was submitted to the Imperial Agricultural Conference on "Entomology in Malaya" and "An Index to the Literature on Malayan Economic Entomology" has been prepared.

3. *Investigations.*

Numerous special investigations have been commenced or continued from previous years. The main researches have been:—

Leptocorisa spp. and their relationship to padi (nearly completed).

The economic importance and control of *Tirathaba rufivena* Wlk. (In progress).

A systematic survey of the Malayan Aleyrodidae.

The Insecticidal Value of *Derris* spp. (In collaboration with the Agricultural Chemist).

4. *Collection.*

Additions have been made to the collection and systematic efforts are being made for their identification, arrangement and preservation. This work has always occupied a considerable amount of time and the Division now possesses a very representative collection of Malayan economic insects.

5. *Review of Insects of 1927.*

(a) *Major Crops.*

Coconut.

Few reports of insects on coconuts have been received during the year. *Artona catoxantha* Hamps. was reported in June on an Estate in Selangor, while *Rhynchophorus schach* Oliv. and *Oryctes rhinoceros* Linn. have been practically suppressed in most districts through the enforcement of control measures. Only on one or two occasions has the latter insect been reported. Breeding grounds were found and efficiently dealt with. *Setora nitens* Wlk. caused trouble at the beginning of the year on young plantations. Outbreaks of this insect would appear to be associated intimately with climatic conditions, for on previous occasions reports of this insect causing serious damage to young coconuts after heavy rains have been received. Considerable attention has been paid to the biology and economic status of *Tirathaba rufivena* Wlk. but progress has been slow and little can be added to what was stated in my last annual report. It is, however, hoped to issue during the year the results which have been obtained up to date. Enquiries concerning the parasites of this moth have been received from Fiji. Three parasites have been identified, the chief being the Tachinid—*Hemimaticera basifulva* Bezzi. Outbreaks of *Hidari thrax*

Box: IA-CA-200002916
Old Pallet: IA-CA-2000029

Hubn. and of *Amathusia phidippus* L. occurred. Of interest is the fact that the latter has not to my knowledge been reported on any previous occasion in Malaya as causing extensive damage.

Rubber.

Considerable attention was paid to the migration of *Orgyia turbata* Butl. from *Mimosa pudica* to rubber, culminating in a detailed report in the M.A.J., Vol. XV, No. 7. It might be recalled that last year this insect migrated from Centrosema to rubber on an estate in Selangor.

Padi.

Considerable work has been done in this Division on the insects affecting padi. The investigation on *Leptocorisa* spp. mentioned in my last report has been completed and an extensive paper which is now being revised should be ready for the press in the course of the next few months. The case-worm, *Nymphula depunctalis* Guen., the Pentatomid bug, *Scotinophara coarctata* Fabr. and the Noctuid caterpillars, *Spodoptera* spp., were reported damaging padi. Towards the end of the year reports were again received from Krian and Province Wellesley of severe damage by the Delphacid, *Sogata pallescens* Dist. This pest was also prevalent in Kedah. Outbreaks of this insect are not of long duration and the length of time available for its study is thereby limited. It was observed, however, that this insect is practically confined to padi growing in stagnant water and increasing the alkalinity would appear to be indicated. Limeing the water might be successful. Confirmation was obtained that changing the water was, as on previous occasions, a successful control. This method was, however, only possible in Krian where an extensive irrigation system exists.

Nipa.

Several visits were paid to the Government Plantation on the Kuala Selangor Road. *Plesispa reichei* Chap. was quite abundant but *Plesispa nipa* Maulik was comparatively rare. *Parasa lepida* Cram. is frequently most troublesome to this crop and is difficult to control. This Limacodid requires to be investigated thoroughly as it is liable to cause considerable damage, before the recommendations for its control are successful.

African Oil-Palm.

A synopsis of the insects affecting the oil-palm was contributed to Bulletin No. 39 on the Oil-Palm in Malaya. *Oryctes rhinoceros* Linn. has been found attacking the bases of the leaf-stalks of oil-palms and the grubs have been reported in refuse heaps on oil-palm estates. The grubs of *Rhynchophorus schach* Oliv. have been recorded on numerous occasions in the trunks of the oil-palm. Since this weevil is largely dependent on *Oryctes rhinoceros* damaging the palm for laying its eggs, attention should be paid to the destruction of the breeding grounds, such as refuse heaps and similar accumulations, on oil-palm estates. If this precaution is not taken serious trouble might ensue.

(b) *Minor Crops.*

Areca.

The Hispid, *Wallacea palmarum* Gestro has been responsible on several occasions for causing the death of this palm. This insect would appear to be a serious pest of this palm and owing to its habit of feeding between the base of the leaf-sheath and the bud, control measures are difficult to apply. No parasites have up to now been recorded. Complaints that the ripe nut of the areca palm suffered from some disease was investigated. Punctures in the rind of the mature fruit were found and similar markings were traced in the youngest fruit. A small unidentified Capsid, which was found in large numbers on newly-opened inflorescences, appears to be responsible. This problem requires careful study.

Citrus.

Information concerning the insects on Citrus, has been sought and most enquiries have been received relating to the control of the caterpillars of *Papilio polytes* L., *Phyllocnistis citrella* Staint. and *Prays citri* Mill. The caterpillars of *Prays citri* bore into the rind of the fruit causing galls and, although recorded from other citrus fruits, lemons appear to be the most susceptible to attack. In one area undamaged lemon fruits could not be found. This insect is undoubtedly a limiting factor to successful citrus cultivation on a large scale and if a mechanical control cannot be found, the question of parasitic control will have to be considered.

Coffee.

The hawk moth, *Cephonodes hylas* L., has been reported on a few occasions but most enquiries have been received concerning *Coccus viridis* Green. This coccid is prevalent wherever coffee is grown in Malaya and spraying with kerosene emulsion has been found an effective control.

(c) *Miscellaneous Crops.*

Amyna punctum F. on croton, *Sylepta balteata* F. on guttapercha, *Pyrausta salentialis* Snell. on maize cobs, the unidentified Cerambycid "borer" of Cloves, *Rhytidodera simulans* White, "borer" of mango trunks, *Miresa bracteata* Butl. on Aleurites, *Glyphodes coeruleiceps* Hamps. on gambier and numerous other insects have caused extensive damage.

Information concerning these and other insects will form the subject of a supplementary report and will be published according to previous custom in the Malayan Agricultural Journal.

G. H. Corbett,

Government Entomologist, F.M.S. & S.S.

Field Division.

Annual Report for 1927.

I.—Staff.

Mr. F. Birkinshaw, Agricultural Field Officer, Perak North, acted as Chief Field Officer in addition to his own duties for the following periods, all dates being inclusive:—March 11th to May 5th: October 10th to November 14th.

During these periods Mr. F. W. South. Chief Field Officer was acting as Secretary for Agriculture.

The Chief Field Officer acted as Agricultural Field Officer, Singapore in addition to his own duties.

Mr. C.L. Newman was appointed an Agricultural Field Officer on September 17th and reported for duty on October 18th from which date he was appointed Agricultural Field Officer, Selangor.

Messrs. R. G. Heath and J. A. Craig were appointed Agricultural Field Officers on October 7th and reported for duty on November 3rd. The former assisted the Agricultural Field Officer, Perak North, and the latter the Agricultural Field Officer, Negri Sembilan whilst gaining experience of their duties.

Inche Uda bin Samsudin, Junior Agricultural Assistant—I record with deep regret the death of this officer from pulmonary tuberculosis at Kuantan on March 3rd.

Promotions.—The following Apprentices were promoted to Junior Agricultural Assistants with effect from April 8th inclusive:—

Federated Malay States.

Inche Abdul Aziz bin Mohamed Nawi	Perak.
Inche Tak bin Haji Daud	
Inche Abdul Malek b. Abdullah Pakih	
Inche Tamby bin Junid	Pahang East.

Straits Settlements.

Inche Mohamed Noordin b. Mohd. Kassim
Inche Ismail bin Haji Taib
Inche Yunus bin Mohamed Din
} Malacca.

Inche Arifin bin Haji Abas, a Junior Agricultural Assistant in Perak, was appointed Senior Agricultural Assistant with effect from January 1st inclusive.

Padi Inspector.—Inche Abdullah Sani bin Kulop Yunus was appointed Padi Inspector in Perak with effect from January 1st inclusive.

II.—Estates Visited.

Area.	Estates.	Visits by request.	Visited more than once.
Perak North - -	7	8	2
Perak South - -	18	11	5
Selangor - -	37	23	2
Negri Sembilan - -	12	11	2
Pahang West -	7	3	—
Penang and Province Wellesley	26	12	9
Malacca - -	20	9	2
Singapore -	—	—	—
Johore - -	103	23	29
Extra Visits by Chief Field Officer - -	8	3	—
Totals	238	103	51

The total of 238 estates visited compares with 209 in 1926, 275 in 1925 and 201 in 1924. As usual routine inspection and advice on the control of disease on Rubber accounted for most of the visits. Other visits were to investigate and advise regarding the control of pests and diseases on Coconuts, Oil Palms, Nipah, Taban Merah, Coffee, Gambier, Bananas and Pineapples. Reasons for other visits were:— Manurial experiments 2 visits. Fruit and Food Production 6 visits. Advice regarding alienation of land 2 visits. Cover Crops

5 visits. Silt from Ravines 2 visits. Flood damage, 4 visits (in Pahang West). Special Reports asked for by the Department 4 visits.

III.—Rubber.

(i) *General.*

The practice of digging silt pits and encouraging the growth of cover crops or grass to improve soil fertility on areas which have suffered from erosion has been further extended during the year.

Importation of bud wood from selected Sumatra stock and selected seed from Sumatra and Java has continued throughout the year.

Further planting of trees for firewood has been carried out on the estate in the Province referred to in my last report. Attempts to establish Casuarina trees has met with little success but trials with the Rain Tree (*Enterolobium Saman, Prain*) and the Buah Saga (*Adenanthera paronina*, Lin.) are proving more successful. Up to the present the Buah Saga has made the more promising growth, the Rain Trees having shown a tendency to branch somewhat more freely than is desirable for the purpose of firewood production.

(ii) *Pests and Diseases.*

(a) *Diseases of the Tapping Surface. Mouldy Rot.* (*Sphaeronema fimbriatum*, E & H.)

This disease was newly reported from 2 estates in Province Wellesley and 9 in Malacca. It has been fairly efficiently controlled everywhere throughout the year and there has been no great increase in the area affected anywhere but minor new infections in certain localities as indicated below.

Perak North.—In July some 15 acres on the Kenas Road and 10 acres at the 26th mile Kuala Kangsar—Ipoh Road. In October about 6 acres at Simpang in Larut district. At the end of the year there were 82 holdings out of tapping as compared with 49 at the end of the third, 45 at the end of

the second and 37 at the end of the first quarter of the year. The increase is due to more rainy weather and does not indicate any less efficient control.

Perak South.—There has been no recurrence of the disease on the area near Sungkai.

Selangor.—The disease was very virulent in all the old areas during the first quarter of the year after wet weather. Special attention to enforce control measures was needed in Kuala Lumpur and Ulu Langat districts. At the end of the year the position is better than it has been of recent years.

Pahang West.—There has been a notable decrease of cases of this disease, especially in Kuala Lipis and Temerloh districts, due to the enforced cessation of tapping during and after the floods.

Province Wellesley and Penang.—The area infected near Junjong on the Province Wellesley—Kedah boundary has slightly increased during the year. A new infection was found on a small area at Pokok Machang in the Northern District of Province Wellesley. The disease has spread to Penang island, areas at Bayan Lepas and Tanjong Bunga being infected.

Malacca.—There has been no marked spread of the disease. Small holders in this Settlement appear to be even more averse than those elsewhere to take measures to control this disease until forced to do so under the provisions of the Pests Ordinance.

Johore.—The disease remains generally localised but there was slight spread in the Kukub and Kota Tinggi districts.

Black Stripe (*Phytophthora* sp.) Cases were found on 2 estates and 8 small holdings in Ulu Kinta, Perak, but yielded quickly to treatment.

Patch Canker (*Phytophthora* sp.) Many cases of a patch canker were found after the heavy rain early in the year on old trees in low lying situations. Although in some instances

the rot had extended over large areas of the inner bark no case of the death of a tree is known to have occurred and the rotting area healed up cleanly with the advent of dry weather, sometimes without any treatment and sometimes after treatment by the cutting away of the dead tissue and cleaning up of the wound.

Unidentified. At the beginning of the year a bark rot was found on a holding on the Telok Rumbar pass, Penang. Its effect was similar to that of Mouldy Rot but differred in that the rot developed from three to four inches above the tapping cut. No trace of *Sphaeronema fimbriatum* was found on specimens sent to the Rubber Research Institute. The same treatment as for Mouldy Rot was successfully applied.

(b) *Root Diseases.*

After the floods many trees in the river mukims of Pahang West succumbed to root disease of which *Ustulina zonata, Lev* (Sacc) was the most common whilst *Kretzschmaria micropus* appeared to be responsible for the damage done in a number of cases. The floods doubtless induced earlier mortality of rubber trees already doomed owing to the presence of root disease. In Perak South one estate has adopted the control of Wet Rot *Fomes pseudoferreus*, (Wakefield) as recommended by the Mycologist and referred to in last year's report.

(c) *Stem Diseases.*

Pink Disease. (*Corticium salmonicolor,* B. & Br.) This disease was very little in evidence during the year. Its control received attention in the Batang Padang and Lower Perak districts of Perak, in Ulu Selangor district in Selangor where it gave some trouble in the first quarter of the year, in the Bahau and Serting areas in Negri Sembilan and in Johore it was fairly common in parts of Segamat and Central Johore. In Pahang West it showed little signs of doing any material damage but its control there was steadily enforced throughout the year.

Die Back.—In South Johore and the Johore River Rubber areas the dying back of one or more of the top branches of rubber trees has been a noticeable feature of the past few years. Preliminary investigation suggested the possibility that damage might be due in some measure to the activity of parasitic fungi, although it was evident that the die back was closely connected with unfavourable soil conditions. The

matter was deemed of sufficient importance to warrant more detailed investigation by the Pathological Division of the Rubber Research Institute and in response to a request by the Inspector of Agriculture, Dr. Weir, head of the Pathological Division of the Rubber Research Institute, visited the most seriously affected areas with the Inspector of Agriculture.

Dr. Weir submitted a comprehensive report as a result of his investigations and the extract therefrom given below summarises the conclusions at which he arrived.

"No fungus was found on the rubber trees showing a dying back of branches that is capable of attacking the upper crown branches under normal condition of growth and none was observed to exhibit epidemic tendencies even under the existing conditions of poor nourishing and exposure of the host. A certain amount of root disease was observed in a few places but not in sufficient quantity as to cause the general picture of die-back so common on many of the sites of the region. There was no leaf diseases other than those usually associated with poorly nourished conditions."

"Die back in the Johore River region is believed to be a direct result of the debility or exhaustion of food supply coupled with adverse physical conditions, of the soil and exposure. The reaction of the roots to these conditions results in a diminution of the assimilatory organs of the higher branches causing them to gradually die back. Since the factors operative in the region are obviously those having to do with poor nutrition, soil moisture and exposure, the problem becomes one of improving the growing conditions of the trees and not one dealing with the primary activities of fungi. The latter are believed to be purely secondary."

(d) *Insect Pests and Miscellaneous.*

"*Boring Beetles.*—Borers did much damage in Pahang West to trees which had been subject to flooding, especially in small holdings. On estates hundreds of trees slightly attacked were saved by prompt treatment. Small holders were advised to treat slightly attacked trees also, but did not follow the advice given—which is perhaps not surprising considering the conditions prevailing in Pahang after the floods.

Orgyia turbata.—On an estate in Province Wellesley this leaf eating caterpillar did considerable damage to a recently planted young clearing of rubber. The caterpillar was present in large numbers feeding on the weeds and the young

rubber plants were eaten in common with the rest of the vegetation. The Rubber Research Institute took over the superintendence of control measures which consisted of systematic collection of eggs and pupae and the changkolling of the whole area to destroy the weeds.

Deer and Monkeys.—In Dindings Deer did considerable damage to trees near jungle areas and monkeys damaged rubber in an estate in Province Wellesley by wantonly defoliating the trees.

IV.—Coconuts.

(i) *General.*

In the following table are given figures kindly supplied by the Commissioner of Trade and Customs showing the exports of copra from the Federated Malay States and Johore for the last 4 years.

State.	Quantity in Piculs.			
	1924.	1925.	1926.	1927.
Perak -	647,710	672,288	748,301	663,587
Selangor -	216,773	259,219	284,970	217,214
Negri Sembilan -	19,805	37,570	57,413	55,471
Pahang -	9,424	5,278	15,243	10,334
Total F.M.S. -	893,712	974,355	1,105,927	946,706
Johore. -	473,610	509,000	576,400	532,000

State.	Value in Dollars.			
	1924.	1925.	1926.	1927.
Perak -	6,914,055	7,830,274	8,905,033	6,862,402
Selangor -	2,427,188	2,909,119	3,212,553	2,615,641
Negri Sembilan -	203,930	463,494	575,451	562,528
Pahang -	95,839	57,412	158,733	102,255
Total F.M.S. -	9,641,012	11,260,299	12,851,770	10,142,826
Johore -	—	6,025,000	6,343,900	5,500,000

Reports of poor crops have been received during the year from estates in Perak and Province Wellesley. The main reason would appear to be dry weather in 1926 which resulted in a fewer number of nuts "setting" than normally. It must also be remembered that the 1926 crop was exceptionally good and it is usual in the case of all fruits for an abnormally heavy crop to be followed by one below average.

In Pahang practically the whole crop of nuts was lost in the flooded areas, the nuts being shaken from the trees by the vibration caused by swiftly running water and battening by logs.

(ii) *Pests and Diseases.*

Black Beetle (*Oryctes rhinoceros*, L.) In parts of the Coast District of Selangor special attention was necessary to ensure reasonable control of this insect. At a pineapple canning factory in Selangor the position regarding the refuse dump which has been a breeding place for large numbers of the insects for a long period, has considerably improved. At the end of the year the dump was surprisingly free of larvae as the result of daily search for them and destruction of all found.

In Province Wellesley the pest is now well under control except in a few cases where incinerators have not been erected to deal with village refuse.

Elsewhere routine inspection served to keep the pest under efficient control.

Hidari thrax, *Hubn.*—Reports of very local damage and of short duration by caterpillars of this Skipper have been received from Kinta, Batang Padang and Lower Perak districts of Perak, near Banting in Selangor and from Dindings.

Artona catoxantha, *Hamps.*—An attack occurred on a small holding at Sabak Bernam but cleared up after about three weeks.

Salmon Pink Disease. There has been no increased mortality of palms from this cause in the Benut area of Johore or elsewhere. Investigations by the Mycologist are still proceeding.

Marasmius sp.—Reference was made in the last annual report to damage by this fungus to Dwarf Coconuts on an

estate in Perak North. Early in the present year several of the palms developed a rotting of the cabbage. Investigation indicated that this was the direct result of injury by the fungus, the mycelium of which was present in such large quantity at the base of the petioles of the affected leaves as to cause the plugging up of the vessels. The affected palms were growing on somewhat unsuitable land.

V.—Padi.

(i) *General.*

(i) *Season 1926—27.*

This crop was a poor one throughout the country excepting in the parts of Kuala Kangsar district of Perak unaffected by the floods and in Malacca where average crops were obtained. Except for these areas planting was late and irregular owing to inclement weather and the weather was unfavourable throughout most of the season which resulted generally in poor growth and scanty tillering, the latter being very marked through the best padi areas in Krian. The Krian crop was only about 9½ million gantangs compared with an average of 14 million.

In most parts the standing crop was further reduced owing to wet weather during harvest.

As mentioned in last years report practically all the Pahang padi, both growing and stored, was swept away by the flood. In Perak the floods completely destroyed approximately 7,500 acres of padi and in Province Wellesley 500 acres.

(ii) *Season 1927—28.*

Again inclement weather resulted in late and irregular planting in many parts of the country but at the end of the year, given dry weather for the harvest, it seems probable that generally a fair average crop may be expected although prospects vary considerably in different districts. In parts of Perak, Province Wellesley and Negri Sembilan *Sogata pallescens*, Dist., the fulgorid bug which did considerable damage in 1925—26 season, again put in an appearance. The effect on the crop will probably prove to be less than on the previous occasion, for padi was this season attacked at a younger stage than before and consequently the plants have had a longer period to recuperate since the pest was got under control.

Perak.—There was great variation in the times of planting in Krian. The crop is fairly forward in the high yielding coastal lands of Kuala Kurau, Tanjong Piandang and Bagan Tiang mukims and in Bagan Serai mukim and a much heavier yield may be expected here than last year, although tillering of the plants is again somewhat below average. In Parit Buntar, Semanggol, Selinsing and Brieh mukim plants are very backward but have recently made good growth and have tillered better than was expected. It is more than probable that inclement weather will be experienced for harvest in these areas on account of lateness, in which case loss of mature grain is bound to accrue.

Prospects are good over Kuala Kangsar and Upper Perak districts whereas plants are somewhat backward throughout Larut.

In Lower Perak the planted area amounts to only about 500 acres this season. Late rains delayed planting and then severe fever and cholera outbreak are responsible for the very small area planted. The crop on this area is bound to be poor owing to attack by rats and insect pests which have come in from surrounding uncultivated areas.

Selangor.—Prospects are poor and the crop will almost certainly be below the average.

Negri Sembilan.—At the end of the year prospects are generally promising.

Pahang.—Here the cultivators have worked hard in the face of great odds and although the area planted is not so extensive as usual, a heavier crop of padi is likely to be harvested than even the most optimistic expected. The position will be dealt with in a later paragraph.

Province Wellesley.—Late planting and dry weather through most of the growing season has affected padi adversely through the large areas of Province Wellesley where the crop depends upon rain and not artificial irrigation for its water. The crop is bound to be poor.

Malacca.—A good average crop is expected.

2. *Pests.*

Sogata pallescens, Dist.—This pest made an almost simultaneous appearance through the Krian, Larut, Kuala Kangsar and Upper Perak districts of Perak towards the end

of November, though with varying degrees as to intensity of attack. Its presence was also reported from Lower Perak, Negri Sembilan and Province Wellesley. The insect was universally present on padi in Krian and Larut districts of Perak. The draining off of water on all areas wherever practicable and its replacement by fresh water, proved a successful measure of control, although in a few areas in Krian the water had to be changed the second time before the insect could be got rid of entirely. Close cooperation of the Public Works Department in Krian enabled the change of water to be effected with very little delay. In the light of past experience it is reasonable to assume that a great loss of crop would have resulted from the attack of this pest had not control measures been promptly carried out. As it is the influence on the crop is only likely to be slight, as the padi was attacked when young and had a long time in which to recuperate after the pest was got under reasonable control.

Padi Fly or Pianggang (*Leptocorisa acuta*, Thumb.) This insect did very little damage in the 1927—28 season. The insects were found on grasses in Kuala Pilah and Tampin districts of Negri Sembilan and in parts of West Pahang and early measures were taken to destroy them.

Kutu Bruang or *Bena Kura* (*Scotinophora coarctata*, F.) This pest was present in considerable numbers in parts of West Pahang and also in Lower Perak. Flooding the fields is the only effective control known for this insect and there was not the water available to do this in most of the areas where it occurred.

Rats again did considerable damage in certain areas in Malacca, Negri Sembilan and Lower Perak.

3. *Organised Rat Destruction.*

(a) *Krian.*

The systematic destruction of rats in the Krian district was again as successful as in the 1925—26 season, in that damage to the crop was extremely slight and confined to minor damage in very small isolated areas. In early December a little damage was found in Bagan Tiang and Parit Buntar mukims. Arrangements were immediately made to mix and distribute large quantities of poison bait in small balls. The cooperation of the District Officer and

through him of Penghulus enabled the distribution to be made throughout the district in a very short time and practically no rat damage is known to have occurred since this was done. During December approximately 12,000 poison balls were made up and distributed and at the end of the year distributions were still being continued at the rate of about 1,000 balls a day.

Comparative figures of rats killed for 1926 and 1927 were:—

	1926.	1927.
Cultivators ...	238,041	256,906
Schools ...	362,020	333,617
P.W.D. ...	73,041	252,268
Totals ...	673,102	842,791

(b) *Province Wellesley.*

In view of the success attained in Krian and the great damage done to the 1926-27 crop of padi in Province Wellesley, a Rat Campaign on similar lines to the Krian Campaign was started in this Settlement in August, special provision having been provided for the purpose on the advice of this Department. Results are considered to have been sufficiently encouraging to warrant a continuation of the Campaign next season. Between September 1st and the end of the year over 100,000 rats were killed.

VI. Minor Crops.

Oil Palm.—The planted area under this crop was increased considerably in Johore and South Perak during the year. In Johore the area planted now approximates to 5,100 acres and one thousand acres have been planted on one estate at Trolak in Batang Padang district of Perak.

Further progress was made during the year in the investigation of the suitability of certain areas in Pahang and Johore for this crop and this work will be continued.

Pineapples.—There was a falling off in production during the year in Johore, the export of preserved pines being 630,943 cases as compared with 643,534 for 1926 and the export of fresh pines to the Singapore factories was 2,500,000

less than in 1926. These figures need not be interpreted to mean that less interest is being taken in the crop: they rather indicate that a large proportion of the planted area is not yet in full bearing. The present area under this crop in Johore approximates to 25,000 acres.

One new canning factory was erected in Johore during the year at the 11th mile Kota Tinggi Road.

Tapioca.—In Johore there was a further falling off in output due to the removal of old areas in the Muar and Segamat districts. Other new areas are, however, being opened up, especially in the northern portion of Johore Bahru district. About sixteen factories were operating during the year.

Areca Palm.—Production in Johore fell off during this year. Areas of young palms at Kluang, Batu Pahat, Benut and Pontian should soon be coming into bearing.

Gambier.— 19,138 pikuls were exported from Johore during the year. About half of the production comes from Kota Tinggi district, but what proportion of this is obtained from secondary jungle areas and what proportion from planted areas is not known. Outside the Kota Tinggi district some 1,800 acres are planted with this crop.

Tuba.—As anticipated in my last report the area under Tuba has increased in Johore during the year where there are now about 1,400 acres under the crop. Two companies are now growing it on a comparatively large area and further extensions are anticipated during the next few years.

In Perak South no further planting took place during the year.

Fruit.—The mid-season fruit crop was a very poor one everywhere but reports indicate that in most places at the end of the year either a good crop was being harvested or was likely to be obtained in the early months of 1928.

Cover Crops.—As stated in the last annual report the planting of cover crops has now become a matter of general agricultural practice in Malaya. The method is undoubtedly generally sounder agriculture than the old practice of clean weeding but discrimination is needed in this as in all other agricultural matters. It has been shown during the year that

In certain localities *Calapogonium mucunoides* is not a desirable cover for Oil Palms as its dense growth provides shelter for rats which are capable of doing considerable damage to the main crop. Furthermore, in some instances this cover has been shown to retard the growth of the young palms. Another instance is recorded where young rubber during dry weather made markedly less robust growth on an area under *Calapogonium mucunoides* than on an adjoining clean weeded area, soil and other conditions on the two areas being similar. In this case experiments are in progress to ascertain if turning under of the cover crop at the commencement of dry weather and allowing regeneration thereof to prevent wash during wet weather will be an advantageous practice. It is desirable that instances where cover crops do not appear to be satisfactory should be brought to the notice of the Agricultural Department, preferably by reporting the facts of the case to the Agricultural Field Officer of the area concerned.

VII.—Miscellaneous Pests and Diseases.

The Giant Snail (*Achatina fulica, Fr.*) During the year this snail was found for the first time in Perak South (near Ipoh) in Penang island (Balik Pulau), and in Johore. In Johore it was found in Malay kampongs at Kampong Baharu and Tarum and was probably introduced from Singapore with pot plants or planting material.

Water Hyacinth (*Eichornia crassipes.*)

Perak.—Accumulations of the weed in the Krian irrigation area were cleared up twice during the year, once at the beginning and once at the end of the year.

The gang commenced at Kuala Kangsar on May 20th to clear up the Sungei Perak and its tributaries working downstream. A point about 6 miles below Telok Anson was reached on September 12th when the work had to be discontinued owing to the cholera outbreak. The Sungei Lumut has been kept clear of the weed throughout the year on a contract arrangement with the Ketua, Kampong Bandar, for $12/- per mensem. The traps erected to prevent weed entering this river from the Sungei Perak have functioned efficiently.

Province Wellesley.—A gang of 12 coolies under a mandor was formed last year. For the first eight months of this

year this gang was employed on clearing the weed from Sungei Kreh, Sungei Jarak and the Sungei Itam. It worked in the Sungei Acheh district for the remainder of the year. Small accumulations of the weed were cleared up where met with in other parts of the country.

Pests and Diseases of Oil Palms.

Rats and Porcupines have been very troublesome in Johore. The latter are now being fairly successfully controlled by the use of cage traps baited with pineapple or nangka but rats, especially where dense cover crops provide shelter for them, are proving more difficult to deal with effectively.

Crown Disease has been fairly prevalent in Johore, especially on palms of about two years old on which it is estimated there is about 10% infection. No case of death from this disease has been met with in Johore.

Setora nitens, Walk.—The caterpillar stage is commonly met with on oil palms but it has so far not occurred in sufficient numbers to do any material damage.

Other Miscellaneous Pests.

Tiracola plagiata, Walk.—The leaf eating caterpillar of this insect damaged coffee on an estate in Pahang. Several bushes were killed in a locality near Slim in Perak as the result of attack by Brown Root Disease.

Parasa lepida, Cram.—Damage to Nipah by this insect was recorded from Selangor.

Pyrausta salentialis, Snell.—The caterpillar, a cob borer, did considerable damage to maize growing in the Dindings.

VIII.—Experiment Stations.

(a) *Padi Stations.*

Perak. Talang Test Station.—As stated in last year's report in 1926—27 season the plants were completely destroyed by floods after having made good growth.

1927—28 season.—At the end of the year the crop promises to be a heavy one. Radin 13 was again planted as the main crop and in the manurial trial plots. Strains planted for comparative trials are Seraup kechil Nos. 1, 36, 48 and 52. Seraup besar No. 15 and Serendah No. 741.

Bota Test Station was again almost a complete failure owing to inclement weather, only a very small area being planted.

Negri Sembilan.—A Test Station was opened at Jelebu and six of the Teti Serong strains have been planted for comparative trials. At the end of the year the plants had made good growth.

Pahang. Dong Station.—1927—28. As the last crop was completely wiped out by the floods it was necessary to get new seed for this season's planting. The following Teti Serong pure strains were obtained from Krian and Malacca and planted:—Radin Nos. 2, 3, 4, 7 and 13. Pahit No. 1. Seraup kechil Nos. 48 and 52. Seraup besar No. 15. Serendah Nos. 756, 824 and 875. At the end of the year the plants were backward owing to a late season and to dry weather in November and early December which checked their growth.

Pekan Station.—Tests with dry padi were again a failure owing to drought. A further 1½ acres of land has been secured for trials with wet padi and this has been cleared of stumps and snags.

Province Wellesley. Pekan Darat Station.—1926—27 season. Owing to a dry season followed by wet weather during harvest results were poor and unreliable.

1927—28 season. Again very dry weather in November has adversely affected the growth of the plants and only a poor crop can be expected.

Malacca. Pulau Gadong Station.—1926—27 season. Owing to the great damage done by rats, notwithstanding all efforts made to keep them in check, the yields were poor generally and records of measurements made are of little use for arriving at a decision as to the comparative worth of the various strains used.

1927-28 season. Plants made good growth for the first two months after planting but since then rats have again done considerable damage. For some time the strain Radin 7 was left alone by the rats but it later shared the same fate as the other strains.

(b) *Other Stations and Experiments.*

Kuala Kangsar Fruit Station.—Cover crops, to provide seed for distribution and green manure for the station and in connection with the padi manurial plots at Talang, have been maintained over the major portion of the station. Two acres are under a mandarine type of orange. A heavy crop was reaped in April over 25,000 fruits being sold realising $308/-. Some selected varieties of Rambutan were planted. A 4 acre block of high land in the Talang reserve was planted with dwarf Coconuts from seed obtained from the Economic Botanist who has yield records of the parent trees. This area is being run as an extension of Kuala Kangsar Fruit Station.

Green Dressing Experiments on Slimed Land.—On the area opened in July 1926 Tephrosia candida and Crotalaria anagyroides have made excellent growth. On the area opened in December 1926 Mimosa invisa has made good growth.

Negri Sembilan Fruit Station.—A demonstration and distribution fruit station was opened in Negri Sembilan in land forming the compound of the Agricultural Field Officer's quarters. 500 seeds of Nutmeg were sown for distribution purposes. 500 Pomelo seedlings were planted out to provide stock for budding with imported varieties of Citrus. A number of the best local varieties of Banana were planted for distribution purposes.

Kuala Lipis Fruit Station.—A small area was cleared towards the end of the year and planted with Limes, Oranges, Grape Fruit, Pomelo and Chiku for distribution.

Pekan Station.—This was utilised mainly for raising stocks of seed and planting material for distritution.

IX. Other Instructional Activities.

Padi Competition.—A scheme for a padi competition was drawn up by the Agricultural Field Officer, Province Wellesley which provided for marks for quality of general cultivation, upkeep of batas, control of pests, planting distances and evenness of the crop. The object was the encourage-

ment of padi planting by awarding a prize to the entrant who had shown the most practical and intelligent industry in the cultivation of his crop. The scheme provided for three visits by the judge, the Agricultural Field Officer. There were 142 entrants. The experiment has emphasised the great difficulty of conducting padi competitions owing to the very large amount of work entailed in judging which is out of all proportion to the results that are likely to be achieved.

School Gardens.—Routine inspection has been carried on throughout the year. Gardens have been re-established in Pahang West. Good progress has been made in both Province Wellesley and Malacca.

Agricultural Shows were held in Taiping, Seremban, Kuala Pilah, Rembau, Balik Pulau and Malacca under the auspices of the Malayan Agri-Horticultural Association.

The Inspector of Agriculture, Johore staged an exhibit illustrating the cultivation and preparation of Gambier at the Malayan Agri-Horticultural Association show at Kuala Lumpur.

Publications.—The following papers by Officers of the Field Division were published in the Malayan Agricultural Journal, Vol. XV, during the year.

"Ustulina zonata (Lev.) Sacc. A Warning Note" by F. W. South.

"The Preparation of Cigarette Wrappers from Nipah Palm" by A. E. C. Doscas.

"A note on the methods of destroying Dead Coconut Palms" by F. R. Mason.

The revised Agricultural Pests Enactment was published in the F.M.S. Gazette on February 11th as Enactment No. 30 of 1926 and came into force on the date of publication.

Revision of the Johore Enactment was also made during the year. This brings the Johore Agricultural Pests Enactment in line with the laws of the Federated Malay States and Straits Settlements.

X. Restoration work in areas devastated by the Floods.

The severe floods in the valleys of the Perak, Pahang and Kuantan rivers were mentioned in my last report but at the time the full extent of the damage done was not known.

In the valley of the Perak river the padi over about 8,500 acres was completely destroyed as were a number of fruit trees. Rubber did not suffer heavily and no very great depth of silt was deposited anywhere.

In Pahang the flood was the worst ever recorded. Practically the whole of the padi, both growing plants and stored grain, was swept away, a large number of fruit trees were destroyed, including Coconuts, and in some cases rubber trees were killed or swept away as well. A large proportion of the "paya" padi land was buried under a layer of silt which varied in thickness according to the position of the "paya", the silt being several feet deep in some cases.

Arrangements were set on foot at once to secure supplies of planting material of foodstuffs, including padi, for distribution in the devastated areas. A second minor flood washed away some early plantings made. It was not possible to obtain any very large quantity of "dry" or "hill" padi seed and certain varieties of wet padi which are known to do fairly well as "ladang padi" in a normal season were used for this purpose. The dry padi crop was however almost a complete failure owing to the very dry weather experienced after planting. In areas where there was an adequate supply of water a very good crop of padi was produced, the yield being very much higher than is usually obtained in Pahang. The silt left behind by the flood has proved therefore to be a very suitable medium for padi. Measurements of yield made in Pahang East averaged over 380 gantangs per acre, ranging from 800 gantangs per acre to 220 gantangs.

A list of the plant material distributed in the areas which suffered from the floods is given below:—

	Pahang.	Perak.	N. Sembilan.	Selangor.	Perlis.	Kelantan.	Total.
Groundnuts -	1,757	...	...	...	...	...	1,757 Katis.
Sweet Potato Cuttings -	123,600	...	..	..		...	123,600 ,,
French Beans -	6	...	...	...	...	...	6 ,,
Kachang Sepat -	100	...		...	...	..	100 ,,
Lima Beans -	10	...	...	...	...	...	10 Tahils.
Green Cowpea -	25	...		...			25 Katis.
White Cowpea -	25	...	...	...	...	...	25 ,,
Brinjal Seeds -	16	...	..	...	...	...	16 Tahils.
Tapioca Stems -	200	...	...	...	...	...	200 Bundles.
Yam Bean Seeds -	75	...	...	...	...	...	75 Katis.
Grean Gram -	60	...	...	..	..	.	60 ,,
Spinach Seeds -	4	...	..	...	...	...	4 ,,
Maize Seeds -	25,352	8,812	435	.		...	34,599 ,,
Chilli Seeds -	3	..	...	...	...	..	3 ,,
Padi -	55,847	32,644	1,103	3,040	50	2,560	95,644 Gantangs

In addition to the above fairly large distributions were made locally from Pekan Experiment Station and in Pahang West a large number of fruit seedlings and seeds have been distributed.

FRANK BIRKINSHAW.
Ag. Chief Agricultural Field Officer,
Federated Malay States.

Division of Mycology.

ANNUAL REPORT FOR 1927.

Staff.—The Mycologist, Mr. A. Sharples, was on leave in England from April 28th to the end of the year, and represented Malaya at the Imperial Agricultural Research Conference in London. Mr. A. Thompson acted as Mycologist during this period. Mr. F. S. Ward, Assistant Mycologist, was engaged on investigations connected with Panama Disease of Bananas.—Good work was done by the Malay subordinate staff:—Raja Abdul Rahman, Mohamed Ramly, and Che Idris.

Rubber.—Enquiries dealing with rubber diseases were handed on to the Rubber Research Institute. The work on rubber carried out in the Mycological section of the Department of Agriculture was confined principally, to studies of *Phytophthora* spp. isolated from various diseases of this host. The *Phytophthora* spp. isolated from rubber tree diseases are being investigated in respect to the general complicated *Phytophthora* problem in Malaya, and are being compared with *Phytophthora* sp. isolated from other host plants. Good progress can be reported, but much still remains to be done.

As far as Patch Canker is concerned two species of *Phytophthora* and a species of *Pythium* have been isolated from diseased bark and proved to be capable of causing the disease in varying intensity. One of the species of *Phytophthora* is *P. faberi* (Maubl.) and is identical with the species causing Black Stripe disease of the tapping out. The other species bears a close resemblance to *P. nicotianae* (Van Breda de Haan), and is very virulent, producing a large cankered patch in seven days if inoculated on to unwounded virgin bark, and kept moist. The fungus does not produce oospores either in pure or mixed culture.

The fungus isolated from Black Stripe is considered to be *P. faberi* (Maubl.). Oospores were only produced when this fungus was grown in mixed culture with *P. palmivora* (Butler) from coconut (India). When mixed with other strains of *P. faberi* (Maubl.) from Cotton, (St. Vincent), Cacao, (Trinidad), Coconut, (Jamaica), Mimusops, (W. Africa) no oospores have been obtained in Malaya, but the

mixture with the cacao strain produced oospores in 1926, when grown at the Imperial Bureau of Mycology, Kew.

Fruit Disease.

In 1924 a *Pythium* sp. was isolated from a disease which appeared on rubber pods produced late in the season. This was found to be identical with the *Pythium* isolated from Patch Canker. A careful watch was kept to see if secondary leaf fall or pod-rot would appear next season, but nothing eventuated, and the fungus has not been noticed since.

In December of this year a few pods fell from a tree in Kuala Lumpur while yet green. These were examined and were found to be diseased at the stalk end. Dark watery areas about $\frac{1}{4}$ of an inch in diameter were noticed and beneath these the tissue was discoloured in as far as the wall of the seed chamber. Cultures resulted in the growth of a species of *Phytophthora* which produces little aerial mycelium, but abundant oospores of the "parasitica" type, on French-bean or potato-dextrose Agar.

Work on this fungus is continuing and results so far indicate that it is not a vigorous parasite on young leaves of *Hevea*. There are no pods available to test it on rubber fruit, and this must be left over until next season.

Malaya has up to now been remarkably free from leaf and fruit diseases, and "secondary leaf-fall" which does serious damage in Ceylon and South India has not been found. The *Phytophthora* sp. last mentioned above is somewhat different in culture to the causal agent (*P. meadii* Mc. Rae) as described by Mc. Rae in S. India in 1918, and is not *P. faberi* (Maubl.) which is responsible for the trouble in Ceylon. Whether it will cause trouble in the future, or whether it will disappear, as occurred with the *Pythium* sp. remains to be seen.

Coconut Palm Diseases.

There were no cases of epidemic bud-rot during the year. The situation with regard to the disease which, in this country, ends with the death of the bud, is much the same as reported last year. A few fresh cases occurred in the coastal areas, where the trouble took the form of a salmon pink discoloration and softening of the central stem tissues accompanied in most cases by a hardening and lignification of the outer tissues. No large area was affected in any one place, usually a group of from 15 to 30 palms becoming

attacked. As before a few fructifications of *Polyporus ostreiformis* (Berk) were found in association with the disease. *Fomes lignosus* (Klotzsch) appeared on some coconut logs which were removed from a diseased area and buried. The fungus is considered to have been present in the soil in which the logs were buried and not to have developed from the logs. A number of coconut palms were inoculated with cultures of *Polyporus ostreiformis*. (Berk), obtained from diseased material, but no success can be recorded to date. The inoculations were made on palms growing in light sandy soil, as only these palms were convenient, but as the soft salmon pink form of the disease has been found only in heavy clay soils, preparations for further inoculations on palms growing in such soils are being made. The soil division examined soil samples from two diseased areas and report that they showed marked acidity when compared with similar soil from unaffected areas in the same locality. On the other hand soil from an inland area, where the extreme lignified form of the disease occurred, was normal.

Coastal areas often experience difficulty in adequately draining certain areas of estate land and it is in these areas that salmon pink disease has been most active up to the present. There is some evidence that palms in the earlier stages of disease may be saved if the soil can be well drained and if a liberal dressing of lime is applied. The evidence is, however, not fully conclusive but is being considered in view of the result of the preliminary soil analysis.

Phytophthora Bud-Rot.

A number of young palms were inoculated with strains of *P. faberi.* (Maubl.) isolated from coconut, cotton, rubber, and cacao. The inoculations were made by boring into the leaf bases just above the bud, with a sterilised cork borer, extracting a plug of tissue, and putting in plugs of boiled papaya fruit on which were growing pure cultures of the various strains, the plug of tissue was then replaced and the wound was bound over with moist cotton wool. Success was obtained, after a long interval, in only one case, with *P. palmivora.* (Butl.) isolated from coconut in India. The remainder of the inoculated palms continued to grow, and, although the leaves as they emerged had the mark of the inoculation on them, no extension of diseased tissue occurred and the bud was unaffected after nine months. The one success reduced the bud to a stinking mass and *P. palmivora.* (Butl.) was recovered from the margin of the diseased tissue.

Further work on *Phytophthora* Bud-rot is contemplated, as it may have been the unusually dry period, following the inoculations, which mitigated against a more uniform success.

African Oil Palm Diseases.

On the whole, Oil Palms have been fairly free from any serious disease, during the year. A few cases of bud-rot were reported, but no fungus considered capable of primarily causing the trouble was isolated. An interesting case of fruit-rot was encountered which may indicate one possible source of Bud-Rot disease. Some large bunches of fruit were received in which the fruits from the apex to the centre of the bunch were rotted. The rotted portion extended, as far as the stalk of the bunch, and it is thought possible that if a parasitic fungus was at work it may reach the main stem and grow into the bud, via the stalk, and cause bud-rot. Examination of the fruits revealed the presence of mealy bugs in large numbers, accompanied by a *Glocosporium* sp. and bacteria. In places the unaffected fruits were apparently being attacked by mealy bugs and—possibly the *Glocosporium* sp. and bacteria follow the injury to the fruits to cause a rot. In previous cases noticed, only the top of a bunch suffered from rot leaving the remainder unaffected, but in this type of rot, mealy bugs have not been noticed previously, and the trouble has been considered to be a natural phenomenon due to lack of nourishment.

Fructifications of *Fomes lignosus* (Klotzsch) were found growing all round the base of a palm on one estate. Fortunately the fungus was only growing as a saprophyte on the pruned leaf bases and the roots of the palm, growing through the "Fomes" infested tissue, were not attacked.

Crown disease continued to give some trouble on areas of young palms. When the palms reach three years of age, the number of cases diminishes. This disease is characterised by a lack of lignified tissue in the affected leaves particularly where they bend over, and may be a result of too rapid growth, induced by excess of some nutritive element.

Areca Palm Disease.

These palms continue to be attacked by what appears to be a root disease. The leaves of affected palms become smaller and eventually drop, one by one, until the crown falls over leaving a bare pole. The stem tissues are soft and spongy and frequently large hollows full of spongy mycelium

are found. Most of the roots are decayed with a dry powdery rot, the outer ones being the first to become attacked. *Polyporus ostreiformis* (Berk), which is mentioned under coconut palm diseases has been obtained from sections of the stem.

Diseases of Rice.

No serious disease of rice was reported, but some work was done in connection with the appearance of *Sclerotium Rolfsii* (Sacc) on some seedlings from Province Wellesley. The fungus was shown to be parasitic on young plants, but should not give trouble in nurseries if the rice is properly grown.

Another sclerotial fungus appeared on mature plants in Perak following a *Fulgorid* pest. The fungus only became evident when the water was drained off the fields during control measures for the pest, and, as far as can be seen, did not do much damage.

Sclerotial Diseases.

In addition to the sclerotial diseases of rice, work on diseases due to *Sclerotium Rolfsii* (Sacc) was continued. An outbreak of disease on Sireh (*Piper Betle*. L.) was found to be due to this fungus, and inoculations showed that the disease can be very serious. The fungus was shown to be the same strain as that which attacks Jerusalem Artichokes, but of a different strain to the strain on rice, although in culture no difference is noticeable. *S. Rolfsii* (Sacc) was also obtained from a disease of *Caladium* sp. and work on this strain is now in progress. The following plants have been recorded as hosts of *S. Rolfsii* (Sacc) in Malaya:—Jerusalem Artichoke (*Helianthus tuberosus*. L.), Sireh (*Piper Betle*. L.), *Crotalaria usaramoensis* E. G. Baker, *Tephrosia candida* D.C. Tapioca (*Manihot utilissima* Pohl.), Ground Orchid (*Spathoglôttis plicata*. Blume.) Soya bean (*Glycine hispida* Maxim), Rice (*Oryza sativa*. L.), and *Caladium* sp.

Banana Diseases.

Attention has been devoted, this year, to a study of diseases of Bananas, with a view to finding out if Panama Disease caused by *Fusarium cubense* (Erwin F. Smith) is

present and if any of the local varieties are immune to this disease. The cultivation of bananas in the West Indies is being seriously threatened by Panama Disease and the work was inaugurated, following a request from the Director of Kew Gardens, asking for co-operation in trying to obtain a variety of banana which is resistant to, or immune from, the disease. The principal banana growing areas were visited by the Assistant Mycologist who found no trace of Panama Disease until the end of the year, when the bananas in one area, previously healthy, showed signs of a disease with certain symptoms similar to those of Panama Disease. The varieties affected by other diseases are "Pisang restali", "Pisang embun", and "Pisang mas". "Pisang restali" suffers from a form of bud-rot, with which a bacterium is associated. This bacterium is believed to be *B. solanacearum* (Erwin F. Smith). A disease with symptoms similar to Javanese Vascular disease, occurs on "Pisang embun" and "Pisang mas", but is more severe on the former. The suspected occurrence of Panama disease has, so far, been noticed only on "Pisang embun" which is considered to be identical with the valuable commercial "Gros michel" variety of the West Indies.

Associated with the bud-rot of "Pisang restali" there is also a species of *Fusarium* which agrees very closely with *F. cubense* (Erwin F. Smith). Inoculations of the bud with the bacterium and this *Fusarium* have not been successful, when tried on young plants. The latter grow so quickly that the inoculum is carried away from the central leaves in a few days. Inoculations at soil level have also given negative results to date.

A *Fusarium* isolated from the disease of "Pisang embun" believed to be Panama disease, is being compared with a type culture recently received from Manila.

Inoculations are in progress with the following native named varieties:—Kipas, Talam, Rajah Udang, Kling, Abu, Susu, Lilin, Masak Hijau, Mas, Kelat, Embun, Awak Legor, Restali and Rajah, and also with the wild variety, *Musa malaccensis* (Ridl.). It is proposed to test these varieties for resistance to Panama disease, using the type culture of *F. cubense*. (Erwin F. Smith) from Manila under careful supervision.

Citrus Diseases.

A number of diseases of citrus trees came under observation, particularly a die-back of limes. No organism capable of producing the disease was isolated and pressure of other work prevented the investigation being carried further. Citrus scab, and various leaf diseases of lime, orange, and pomelo, were recorded.

Cotton.—*Gossypium* sp.

A slight outbreak of "Angular leaf-spot" due to *Pseudomonas malvacearum*. (Erwin F. Smith) was recorded from an experimental plot in Kuala Lumpur, but the damage done was negligible.

Mangrove.—*Rhizophora* sp.

A disease of bakau (*Rhizophora* sp.) radicles was reported by the Forest Department. The radicles while attached to the fruit, become diseased in the centre, and the disease spreads towards the tip. The tissue in the diseased portions is discoloured brown and gives off an odour like that of ripe strawberries. A *Fusarium* sp. is associated with the trouble.

Chengal.—*Balanocarpus Heimii*. King.

A serious disease of this important hard wood tree came under observation in November. The causal fungus is a large "*Fomes*" (*F. Setulosus* Lloyd.) which causes a chocolate-brown rot of the wood, and renders it unfit for use as timber.

Miscellaneous.

A number of enquiries on diseases, and specimens of diseased material of miscellaneous crops were dealt with during the year. These included:—brown root disease, and leaf disease of coffee (*Hemileia vastatrix*. B. & Br.), Grey Blight of Tea (*Pestalozzia Theae*. Sawada), leaf diseases of Sireh (*Piper Betle* L.) due to (1) Bacteria, (2) *Colletotrichum* sp.; Sudan Grass leaf spot due to (*Hendersonia* sp.), Pineapple bud-rot, associated with bacteria. Mangosteen leaf disease (*Pestalozzia* sp.) Brinjal (*Solanum Melongena*. Linn.) fruit rot due to *Vermicularia capsici* (Sydow), Royal Palm (*Oreodoxa regia H. B.*) leaf spot due to *Helminthosporium* sp. and leaf spot of Cloves due to *Pestalozzia* sp.

Some time was spent in establishing cultures of the fungus causing Mouldy rot disease of rubber. These were despatched to Kew, but arrived in bad condition. During this work attempts were made to establish Mouldy rot on the tapping cuts of some isolated trees in the Departmental Plantation. All attempts failed, both when cultures were used, or when pieces of infected bark, freshly obtained from an area in Kuala Lumpur, were pinned to the tapping cut. This result is similar to that obtained by Belgrave in 1918, when carrying out inoculations with *Sphaeronema fimbriatum* (E. et. H.) Sacc. on these trees. *S. fimbriatum* (E. et. H.) Sacc. from Mouldy Rot, was inoculated into sweet potato tubers, but the result was negative both with tubers growing in pots and with tubers kept in moist chambers.

Work was continued on the *Phytophthora* isolated from Sireh (*Piper Betle*. L.) in 1924. The fungus produced oospores in pure culture when grown at Kew in 1926. These were of the "parasitica" type and were produced in fair quantity. On returning to Malaya the fungus when cultured on the same media, did not produce oospores even when kept in an ice chest at 22°—25°C. From observations made at Kew Mr. S. F. Ashby considers that the fungus may be *P. colocasiae*. (Raciborski) and at Kew the Malayan fungus is very similar to the type *P. colocasiae*. Chicago (1409). This type has now been grown in Malaya and continues to produce oospores at room temperature. Attempts are being made to invigorate the Sireh fungus, before comparing it with the type culture.

Publications.

An illustrated article on "Diseases of the Oil Palm" was prepared for the Malayan Agricultural Journal Vol. XV. Nos. 9 and 10. An article on "Diseases of Fruit Trees" was prepared for translation into Chinese for the Chinese Bulletin published by the Department.

A. Thompson,
Ag. Government Mycologist, F.M.S. & S.S.

Division of Soils & Plant Physiology.

Annual Report for 1927.

Organisation.

This composite Division was brought into being in February by the transfer of Mr. J. H. Dennett and 3 Junior Officers from the Division of Agricultural Chemistry.

It was subsequently decided to experiment with a number of Laboratory Attendants, quite untrained lads who had passed the V or VI Standard in English schools, working directly under the Malay Officers trained in the Department. Four Laboratory Attendants were appointed in August and it can now be said that the experiment has proved satisfactory; the capacity for work of the Division having been greatly increased at almost negligible cost to Government.

Accommodation.—The office formerly occupied by the Agriculturist, Rubber was handed over to the Division in May and fitted up as a Soils Laboratory.

Work.

Mr. Dennett has carried to a conclusion his work on the production of alcohol from Nipah Palms—two articles have been published.

The work of the Division has been on soils rather than on plant physiology, the former presenting the more urgent problems.

Immediately after the formation of the Division a programme outlining the general scope of contemplated work was submitted to, and approved by the Secretary for Agriculture and Advisory Committee.

A considerable portion of my own time has been devoted to the preparation of an adequate index to the relevant portions of the recent and voluminous literature of soil science. The work was completed by November and keeping up to date is now a simple matter. The need for such an index is obvious and the absence of it caused the waste of several weeks

work on the absorption of certain anions by iron and aluminium hydroxides on lines which had already been explored by Gordon and Starkey.

Research Work.—The field for soil work in Malaya is virgin to an exceptional and embarrassing degree, not only have no systematic investigations hitherto been carried out, but as far as the rolling or hilly inland soils (the back-bone of the country) are concerned there is absolutely no information as to their cultural characteristics which could be used as a basis for research. The reason for this is that our only inland large scale crop, rubber, is remarkably tolerant of a wide range of soil conditions and that manuring of rubber has never been practised.

The most urgent problem appeared to be that of systematics, viz. the establishment of soil types and the relating of these types to the underlying parent material.

Next in order came the question of the fertility of padi soils. In addition to these main lines of work a number of other problems were somewhat cursorily examined with the idea of finding useful lines of attack for the future.

Soil types.—To characterise types it was decided to carry out a soil survey of a limited and accessible area. The area selected was a strip in Selangor running from Cheras, through Serdang along the Klang valley to the Coast. This area has the advantage of including all the important geological formations on the west side of the Peninsula and also of including the Government large scale experimental plantation at Serdang.

Preliminary experiments showed the Robinson method of analysis to be suitable, and this has been used throughout for mechanical analyses. It has been found that treatment with hydrogen peroxide is unnecessary for most of our mineral soils and this has been omitted when dealing with such soils. It was also decided not to ignite before weighing fractions.

The survey at the end of the year had reached the Ayer Hitam Forest Reserve, and a fairly complete idea of the distribution of what may be called the upland soil types in the area chosen has been obtained.

Five hundred and twenty seven samples representing one hundred and twelve profiles have been collected and mechanical analyses completed, of these 281 samples were taken on the Experimental Plantation.

Mineralogical examination of the heavy fractions of a number of these samples and chemical determination of the silica/sesquioxides ratio are in progress.

Chemical composition and cultural character of soils.—A certain amount of preliminary work was carried out on chemical composition and base exchange properties, but it was soon decided that a knowledge of cultural characters was an essential pre-requisite if time was not to be wasted on a mass of determinations which might subsequently be found not to "fit". A number of manurial pot culture experiments were therefore started and are in progress—according to expectation, these preliminary experiments indicate phosphorus to be the chief limiting factor.

In addition, the necessity for experimental blocks scattered through the country on different types of soil was strongly impressed upon the Departmental Technical Committee. It is hoped that such blocks will be laid out as soon as the necessary supervision can be provided by the Division of Agriculture.

The 'foraging' power of tropical plants.—This problem is being attacked along two lines, by plant cultures

(a) on the coarser soil fractions

(b) on soil leached with acids of various strengths.

Physical constants.—A few determinations of the Atterberg, Keen, and moisture equivalent constants were made, but is seemed better for the present to rely on mechanical analyses and the work was therefore suspended.

Acidity of soils.—All samples examined are tested in suspension by the quinhydrone electrode; as I have pointed out (M.A.J. XV), many of our soils show large discrepancies between the pH values of suspensions and of clear extracts made in the usual way, suggestions were made of two ways in which these discrepancies could be produced. Further work has convinced me that absorption by iron or alumi-

nium hydroxides is not a factor, and that the alternative suggestion viz. the absence of soluble salts to provide anions to act as "carriers" of hydrogen ions is correct.

The other suggestion made in the preliminary note referred to was that such soils may not be physiologically acid at all. Work on this point is proceeding.

Padi Soils.—In view of the importance of sources of food supply it was decided in May to undertake a comprehensive survey of padi soils with a view to ascertaining the soil factors affecting fertility. The Chief Field Officer kindly arranged for samples and estimates of yield to be taken by the Agricultural Field Officers. Up to the end of the year 103 samples chiefly from Malacca had been received. A simplified method of mechanical analysis was adopted—the soil after treatment with hydrogen peroxide was dispersed by shaking with sodium hydrate and a hydrometer reading taken in the manner described by Bouyoucos, the sand was determined as usual by decantation. Determinations were also made of buffer action, and of pH values.

No correlations have yet been established between yield and any factor; in view of the small number of samples examined and the large influence of external conditions this is not surprising. It is hoped that the examination of a much larger number of samples and statistical treatment may reveal such correlations.

One observation of importance which has emerged is that the presence of a medium or high percentage of sand does not necessarily result in low yield, great caution should therefore be used in condemning any proposed area on the score of a high sand/clay ratio.

Analyses were made of a number of samples of soil deposited by floods in Pahang. Most of the deposits were silty in nature, and some contained more calcium (a good index of degree of leaching) than usual. The opinion was expressed that provided difficulties with water supply could be overcome there was no reason to anticipate difficulty in growing padi. In fact, bumper harvests have been obtained from some of the areas.

Another line of attack on the padi problem is obviously that of direct experiment; unfortunately field experiments

with padi appear to be extremely difficult in Malaya owing to the uncertainty of the seasons and the depredations of rats and birds on small areas. A scheme was therefore put before the Departmental Food Production Committee for the provision of a number of experimental tanks, protected from pests and with a controlled water supply. A site has been selected and it is hoped to start work in 1928.

Coconut soils.—Attention has been paid to areas on which salmon pink disease has occurred. The soils have been examined for pH value, nitrates, mechanical composition, and soluble iron and aluminium. No factor common to all the diseased patches has been found—work however is continuing.

Cover crops.—Field examination of the roots of some imported leguminous covers showed a distinctly sparse development of nodules and threw doubt on the usual claim of extensive nitrogen enrichment by the use of such covers. Sand cultures were therefore started and are in progress.

The effect of a thick cover on the moisture content of flat land has been under investigation at Serdang.

A case of suspected injury by cover-crops to young coffee plants is being investigated. No toxic aldehydes or similar substances have been detected.

Miscellaneous.—

1. Comparison was made of a number of methods of determining nitrates, with all methods there was difficulty in recovering nitrate added to the soil, best results were obtained by clarification with lime alone.

2. Determinations of the total nitrogen in samples of soil from virgin jungle showed a very similar content to that of similar soil which has been under rubber clean weeded and extensively washed for at least 23 years. This is clearly a matter of great importance calling for further investigation in conjunctions with a bacteriologist.

3. A number of percolation experiments to determine losses on leaching following the application of various manures were started.

4. Pot experiments on the use of sulphur as a measure of soil amelioration for some of our heavy alluvial soils containing large quantities of sodium complexes have been started.

5. Tests were made of the Bouyoucos' method of moisture content determinations by the use of alcohol. No advantage could be found for the new over the old method.

Routine work.—207 soil samples were examined for members of the public and officers of this and other Departments. Owing to the extensive use of subordinates, these analyses do not seriously interfere with research work in progress.

General.

During the course of a visit to Java, the writer visited Buitenzorg and was most cordially received at the Department of Agriculture and Central Testing Stations for Tea and Rubber. A report on the visit was made to Government; in addition to much useful information gathered, the establishment of personal relations with "opposite numbers" should prove most useful in the future. Welcome help has been given to the Division by the Geologist F.M.S.

Publications.—

Final observations on the Nipah Palm as a source of alcohol, by J. H. Dennett. (M.A.J. December, 1927, Vol. XV).

Alcohol fuel and the Nipah Palm, A popular outline, by J. H. Dennett. (M.A.J. December, 1927, Vol. XV).

Acidity Determinations on Malayan Soils. A Preliminary Note, by W. N. C. Belgrave. (M.A.J. June, 1927, Vol. XV).

W. N. C. Belgrave,

Plant Physiologist, F.M.S. & S.S.

Agricultural Instructor (Malay Officers.)

ANNUAL REPORT FOR 1927.

1. STAFF.

Raja Musa was appointed Junior Agricultural Assistant in this Division on 19-4-27.

2. MALAY APPRENTICES.

At the beginning of 1927 there were 30 Apprentices in training, as follows:—

	F.M.S.	S.S.	Johore.	Kedah.	Total.
1st Year	... 9	2	—	—	11
2nd Year	... 13	3	2	1	19
Total	... 22	5	2	1	30

One 2nd Year Apprentice (F.M.S.) was dismissed on 21.2.27. The remaining 18 2nd Year students completed their course in March.

One 1st Year Apprentice (F.M.S.) resigned on 28.2.27, and one (F.M.S.) was transferred to the F.M.S. Police on 21.3.27. One Apprentice was recruited for the Colony on 15.1.27.

There were, therefore, 10 students in training at the end of the training year, of whom 9 were promoted to the 2nd Year Class in May, 1927.

14 Malay Apprentices were appointed in April and May, of whom 13 commenced their training as 1st Year students on 2nd May and one on 7th May, 1927. They were recruited as follows:—

F.M.S.	S.S.	Johore.	Kedah.	Total.
9	1	3	1	14

There were no casualties among the 9 2nd Year students during the remainder of the year, but one 1st Year

student (F.M.S.) was transferred in September to the Education Department and one (F.M.S.), I regret to add, died on 22nd August.

The strength of the School at the end of the year was, therefore, as follows :—

	F.M.S.	S.S.	Johore.	Kedah.	Total.
1st Year ...	7	2	3	1	13
2nd Year ...	7	2	—	—	9
	14	4	3	1	22

3. Training.

Three terms were held during the year, as follows :—

3rd Term 15th January to 2nd April, 1927.

1st Term 30th April to 3rd August, 1927.

2nd Term 10th September to 22nd December, 1927.

Lectures were given by the Agricultural Instructor (M.O.) and the Assistant Agricultural Instructor, the former mainly to 2nd Year students, the latter mainly to 1st Year students.

The lack of an additional Instuctor was felt throughout the year.

A number of days in the 1st Quarter were devoted to field work; but, for various reasons, it was found impossible to devote adequate attention to the practical side of training during the remainder of the year.

Instruction in Typewriting was also abandoned at the end of the 1st Quarter, the Education Department being unable to renew the arrangements which had existed hitherto.

Lectures and Debates in English were continued, but had to be somewhat curtailed during the final Quarter of the year.

Promotion Examinations for 2nd Year students were held in March, 15 out of 18 students proving successful.

Of these, 9 F.M.S. and 3 S.S. students were promoted to Junior Agricultural Assistant on 8.4.27 and were allotted to Divisions as follows:—

Field Division	...	7 (4 F.M.S.+3 S.S.)
Economic Botanist	...	1
Mycologist	...	1
Entomologist	...	1
Agriculturist	...	1
Agricultural Instructor (M.O.)	.	1

Of the remaining 3 successful students, two returned to Johore, and 1 was given three months' extra training (at the request of the Kedah Government) under the Ag. Chemist, Entomologist, Agriculturist and Economic Botanist, at the conclusion of which he returned to Kedah.

Of the 3 unsuccessful students, one was appointed an Assistant Artist on a year's probation; and two were referred for further training under the Chief Field Officer and the Agriculturist respectively. The latter student passed a promotion examination in September.

Progress examinations for 1st and 2nd Year students were held at the end of the other two terms.

The comparative weakness of Selangor students is still a feature of these examinations.

Two 1st Year students obtained Government loans during the year to enable them to study for the London Matriculation examination in addition to their ordinary studies.

4. Health.

The health of the Malay Apprentices was good during the 1st Half Year, but was subsequently unsatisfactory. Since the beginning of the rainy season in August, about 50 *per cent.* of the students have been in hospital for various periods, mainly owing to Malaria, from which one student died while on vacation in August. One student was absent for practically the whole of the second term through beri-beri. The prevalence of sickness naturally interfered with training, seriously retarding general progress and handicapping the

victims even more seriously. The present students impress one with their apathetic attitude towards Malaria and few of them take the obvious precautions. Enquiries shew that, in every case, the victims have suffered from malaria before joining this Department.

At the Agricultural Instructor's request, a lecture was given by an officer of the Medical Department, F.M.S., in November, in an effort to stimulate interest in Hygiene.

5. Discipline.

The discipline of the Malay Apprentices improved rapidly during the first few months of the year, and has since been satisfactorily maintained. Unpunctuality is practically unknown, and the majority of students devote a reasonable time to study out of school hours.

6. School of Agriculture, Malaya.

The committee appointed in 1926 to draw up a scheme for a School of Agriculture as a joint institution for the F.M.S. and S.S. presented its report to Government early in 1927 (Federal Council Paper No. 12 of 1927), and the report has been accepted in principle.

The preparation of the school site of 22 acres at Serdang was begun in September, and the jungle had been felled, burnt and cleared by the end of the year.

An Advisory Committee for the School was formed towards the end of the year, with the Agricultural Instructor (M.O.) as Secretary, and met on 30.11.27 to consider questions of buildings, staff, *etcetera*. Preliminary plans and estimates, prepared by Messrs. Swan & MacLaren, were tabled at the meeting and were subsequently submitted to Government together with the Committee's recommendations.

7. Scheme for Malay Officers.

Proposals were submitted in August, and were approved by Government, whereby the training of Malay Apprentices recruited in and after 1928 shall extend over three years instead of two as at present. Malay Apprentices appointed under the amended scheme will receive subsistence allowance at the rate of $40, $45, $50 p.m. respectively during the three years of the course.

8. General.

The Agricultural Instructor (M.O.) served as Joint Hon. Organising Secretary of the Malayan Agri-Horticultural Association during the year.

The Assistant Agricultural Instructor and ten selected Malay Apprentices assisted at the Malayan Exhibition held in Kuala Lumpur from July 29th to August 1st inclusive.

The Agricultural Instructor (M.O.) was granted a commission in the Selangor M.V.I. early in the year, and commanded the Malay Platoon, Kuala Lumpur.

Raja Musa was promoted to Sergeant in the same volunteer force, of which the majority of the Malay Apprentices are members.

The Agricultural Instructor (M.O.), Raja Musa and 9 Apprentices attended the annual training camp at Port Dickson from 20th to 27th August inclusive.

A small English Library was instituted early in the year for the benefit of the Malay Apprentices, and the Agricultural Department Football Club was revived, and competed in the Selangor Association Football League.

G. E. Mann,

Agricultural Instructor (M.O.), F.M.S. & S.S.

Publications and Library 1927.

Publications.—The Malayan Agricultural Journal Volume XV: of which Nos. 9 & 10 were reprinted as Special Bulletin No. 39—"The Oil Palm in Malaya".

Finance.—

Expenditure on Publications	...	$6,614.43
Revenue from Publications	...	1,657.50

Distribution of Publications (M.A.J.)

December 1926.	Subscribers.	Free List. (Officials & Others).	Exchanges.
Local	134	140	17
Foreign	66	40	219
Total	200	180	236

Grand Total 616.

December 1927.			
Local	128	153	17
Foreign	72	37	230
Total	200	190	247

Grand Total 637.

Library.—The work of the Library continues to run smoothly, and some of the arrears of binding have been overtaken.

W. N. C. Belgrave,
Editor,
Malayan Agricultural Journal.

Publications of the Department of Agriculture.

The following publications, except those out of print, may be obtained on application to the Office of the Secretary for Agriculture; and the Malay States Information Agency, Malaya House, 57 Charing Cross, Trafalgar Square, London.

A remittance to cover the cost should accompany applications; otherwise the Journals will be sent by post, Cash on Delivery, where that system is in force.

1. The Agricultural Bulletin F.M.S.

Vols. I—IV (1913-16) VIII & IX (1920-21) price $5.00 per volume.
Vol. V (1917) Nos. 1, 2, 3, 5 & 6 ,, 2.50 per set.
Vol. VII (1919) ,, 2—6 ,, 4.50 per set.

(Vol. VI is out of print.)

2. The Malayan Agricultural Journal (continuing the Agricultural Bulletin) Published monthly.

Vol. X (1922) to Vol. XII (1924) } Price $5.00 per volume.

Vol. XIII (1925) to Vol. XV (1927) } Price $5.00 per volume or 50 cents per single number.

Back numbers of Vols. I.—XII will not be sold singly.

3. The Handbook of Malayan Agriculture, price $1.00.

Current numbers of the Malayan Agricultural Journal and the Handbook may be purchased from the Singapore Branch of Messrs. The Federal Rubber Stamp Co.

4. *Special Bulletins.*

1. Notes on *Termes Gestroi* and other species of Termites found on Rubber Estates in the Federated Malay States, by H. C. Pratt, 1909, 20 cts.
2. Root Disease of *Hevea Brasiliensis*, by W. J. Gallagher. C
3. Observations on *Termes Gestroi* as affecting the Para Rubber Tree and methods to be employed against its Ravages, by H. C. Pratt, 1910, 20 cts.
4. *Brachartona catoxantha, Hamps*, by H. C. Pratt, 1909. C
5. The Extermination of Rats in Rice Fields, by W. J. Gallagher, 1909. C
6. Branch and Stem Disease of *Hevea Brasiliensis*, by W. J. Gallagher, 1909. C
7. Coffea Robusta, by W. J. Gallagher, Government Mycologist, 1910, 20 cts.
8. The Cultivation and Care of the Para Rubber Tree (in Malay) 1910. C
9. Die-Back Fungus of Para Rubber and of Cacao, by K Bancroft, 1911. C
10. A Lecture on the Para Rubber Tree, by W. J. Gallagher 1910. C
11. Coconut Cultivation, by L. C. Brown, 1911 C
12. Padi Cultivation in Krian, by H. C. Pratt, 1911. C
13. A Root Disease of Para Rubber, *Fomes Semitostus*. by K. Bancroft. 1912, 20 cts.

C = Cancelled